CLAWSON PUBLIC SCHOOLS

DISTRICT WIDE REMODELING

CLAWSON, MI

MARCH 9, 2015

R.C. HENDRICK & SON, INC.
CONSTRUCTION MANAGER
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ARCHITECT / ENGINEER
600 PARKDALE RD.
ROCHESTER, MI 48307
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SECTION 00 0100

PROJECT DIRECTORY

PROJECT:	Clawson Public Schools District Wide Renovations
PROJECT LOCATION:	Clawson Public Schools 626 Phillips Avenue Clawson, MI 48017
CONSTRUCTION MANAGER:	R.C. Hendrick & Son, Inc. 2885 S. Graham Road Saginaw, MI 48609 989.781.8116 (phone) 989.781.9512 (fax) Chip Hendrick chip@rchendrick.com
ARCHITECT:	French Associates, Inc. 600 Parkdale RD Rochester, MI 48307 248.656.1377 (phone) 248.656.7746 (fax) Barb Lovell

END OF SECTION 00 0100

SECTION 00 0110

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ARCHITECTURAL / ENGINEERING DOCUMENTS ISSUED FOR BIDDING

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SECTION 00 1000

ADVERTISEMENT FOR BID

Notice is hereby given that Clawson Public Schools is receiving bids from trade contractors for the following project:

DISTRICTWIDE RENOVATIONS

Complete proposals will be received for the following work categories in accordance with drawings and specifications as prepared by the Architect, Engineers and Construction Manager.

PROJECT KEY:

PROJECT 1 –SCHALM ELEMENTARY
Site Improvements, Storage Building, Flooring Replacement, Interior and Exterior Architectural Upgrades, Mechanical and Electrical Upgrades, New Roof, Restroom Upgrades

PROJECT 2 – KENWOOD ELEMENTARY
Interior and Exterior Architectural Upgrades, Gym Floor Refinishing, Mechanical and Electrical Upgrades, New Roof

PROJECT 3 – CLAWSON MIDDLE SCHOOL
New Tennis Courts, New Roof, Interior Architectural Upgrades, Mechanical and Electrical Upgrades, Boys Locker Room Renovation

PROJECT 4 – CLAWSON HIGH SCHOOL
New Soccer Field Turf, Site Improvements, Storage Building, Interior Upgrades, New Pool Pumps, Miscellaneous Mechanical and Electrical Upgrades, Pool Locker Replacement

PROJECT 5 – BAKER ADMINISTRATION BUILDING
Site Improvements, Parking Lot Improvements, Installation of New Entrance Canopy, Interior Renovations, New Roof, Mechanical and Electrical Upgrades

PROJECT 6 – BUS GARAGE PARKING
New and Added Site Lighting, Parking Lot and Drainage Upgrades and Motorized Gate

PROJECT 7 – ATHLETIC FIELD STRUCTURES
Remodeling of Team Room, New Metal Roof, New Stairs to Press Box and New Press Box Windows

BID CATEGORY 1: **EARTHWORK / SITE DEMO**
Projects Include: 1,3,4,5,6

BID CATEGORY 2: **PAVING**
Projects Include: 1,3,6

BID CATEGORY 3: **CONCRETE**
Projects Include: 1,3,4,5,6

BID CATEGORY 4: **SPORTS FIELD TURF REPLACEMENT**
Projects Include: 4

BID CATEGORY 5 **TENNIS COURT CONSTRUCTION**
Projects Include: 3

BID CATEGORY 6: **SPORTS/GYM EQUIPMENT**
Projects Include: 1,2,4

BID CATEGORY 7: **GENERAL TRADES / SELECTIVE DEMOLITION**
Projects Include: 1,2,3,4,5,6,7

BID CATEGORY 8: **FENCING**
Projects Include: 1,3,4,6

BID CATEGORY 9: **MASONRY**
Projects Include: 3,4,5

BID CATEGORY 10: **METALS**
Projects Include: 4,5

BID CATEGORY 11: **ROOFING-1**
Projects Include: 1,2

BID CATEGORY 12 **ROOFING-2**
Projects Include: 3,4,5

BID CATEGORY 13: **METAL ROOFING PANELS**
Projects Include: 7

BID CATEGORY 14: **DRYWALL / ACOUSTICAL**
Projects Include: 1,2,3,4,5,7

BID CATEGORY 15: **PAINTING-1**
Projects Include: 1,2,5,7

BID CATEGORY 16: **PAINTING-2**
Projects Include: 3,4

BID CATEGORY 17: **WINDOWS/ALUMINIM STOREFRONTS/FRP ENTRANCES**
Projects Include: 4,5,7

BID CATEGORY 18: **EPOXY FLOORING**
Projects Include: 1,2,3,4

BID CATEGORY 19: **PORCELIN/CERAMIC TILE**
Projects Include: 2,3,4

BID CATEGORY 20: **RESILIENT FLOORING/CARPET/SHEET FLOORING-1**
Projects Include: 1,2,5

BID CATEGORY 21: **RESILIENT FLOORING/CARPET/SHEET FLOORING-2**
Projects Include: 3,4

BID CATEGORY 22: **WOOD GYMNASIUM FLOOR REFINISH**
Projects Include: 2

BID CATEGORY 23: **METAL LOCKERS**
Projects Include: 3,4

BID CATEGORY 24: **BLEACHERS**
Projects Include: 4,7

BID CATEGORY 25: **MECHANICAL-1**
Projects Include: 1,2,5

BID CATEGORY 26: **MECHANICAL-2**
Projects Include: 3,4,7

BID CATEGORY 27: **ELECTRICAL-1**
Projects Include: 1,2,5,6

BID CATEGORY 28: **ELECTRICAL-2**
Projects Include: 3,4,7

BID CATEGORY 29: **BLINDS/ROLLER SHADES**
Projects Include: 1,2

BID CATEGORY 30: **VISUAL DISPLAY BOARDS**
Projects Include: 5

BID CATEGORY 31: **CLASSROOM CASEWORK**
Projects Include: 2,5

Bids will be received at the Office of the Superintendent until **Tuesday, March 24, 2015 at 2:00pm** at which time the bids will be publicly opened and read aloud. Bids are to be delivered to the Baker Administration Building.

Proposals should be submitted in TRIPLICATE and be addressed to

Monique Beels - Superintendent
Clawson Public Schools
626 Phillips Avenue
Clawson, MI 48017

R.C. Hendrick & Son, Inc. is the Construction Manager on this Project. Please do not phone, fax, or email bids to the Construction Manager.

This is a prevailing wage project.

The Owner reserves the right to reject any, part of any or all bids and to waive all informalities in the bidding procedures. The Owner reserves the right to reject any bid when Bidder fails to submit data required by the Bidding Documents, or if the bid is submitted incomplete or irregular. No telephonic, telegraphic, email, fax bids or modification to a submitted bid will be received or considered by the Owner.

Each bid that exceeds Fifty Thousand Dollars ($50,000) must be submitted with an attached certified check or bid bond from a surety company approved to do business in the State of Michigan, payable to the Owner in an amount not less than five percent (5%) of the base bid.

Bids may not be withdrawn for a period of sixty (60) days after the bid date.

FAMILIAL DISCLOSURE

Bidders ***must*** provide familial disclosure in compliance with MCL 380.1267 and attach this information to the bid. The bid shall be accompanied by a sworn and notarized statement disclosing any familial relationship that exists between the Owner or the employee of the bidder and any member of the board, intermediate school board, or board of directors or the superintendent of the school district, intermediate superintendent of the intermediate school district, or chief executive office of the public school academy. **The District shall not accept a bid that does not include this sworn and notarized disclosure statement.**

PRE-BID CONFERENCE

There is a pre-bid conference scheduled on **Tuesday, March 17, 2015 at 12:00pm.** Please meet at Baker Administration Building Board Room located on the 2nd floor.

QUESTIONS / RFI's

All questions regarding the plans and specifications are to be emailed to R.C. Hendrick & Son, Inc. Attn: Chip Hendrick at chip@rchendrick.com.

DRAWINGS, SPECIFICATIONS AND ADDENDUMS

Plans, Specifications and Addendums will be available for download from the R.C. Hendrick Plan Room located at www.rchendrick.com. Click on "Plan Room" and then follow the link to access the project files. If a password is required to access the files, please email the Project Manager associated with the project.

Plans, Specifications and Addendums are also available for purchase from R.C. Hendrick. The cost is $2.00 per drawing sheet and $0.05 per specification page. If you intend to order plans, please email Iris Childs: ichilds@rchendrick.com.

Addendums will be posted to R.C. Hendrick's Online Plan Room. Addendums will be posted no later than 12:00 Noon on the day before the bid is due. R.C. Hendrick will send out a notice that an addendum is available to all known planholders. **It is the responsibility of every bidder to check the project site for addendums and note them on the bid form.**

END OF SECTION 00 1000

SECTION 00 2000

INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

Definitions set forth in the General Conditions of the Contract Construction, AIA Document A201 – Current Edition, and in other contract documents are applicable to the Bidding Documents.

Bidding Documents: Bidding Documents include the Drawings, Specifications, Addenda prepared by the Architects, Engineers, Consultants and Construction Manager and anything referenced within those documents.

Addenda: Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

Bid: A bid is a complete and properly signed proposal to do the work for a stipulated sum, submitted in accordance with the Bidding Documents.

Base Bid: The sum stated in the Bid Form for which the Bidder offers to perform the work described in the Bidding Documents as the Base Bid.

Alternate: An alternate is an amount stated in the Bid to be added or deducted from the Base Bid if the corresponding change in the work, as described in the Bidding Documents, is accepted.

Unit Price: An amount stated as a price per unit of measurements for materials or services described in the Bidding Documents.

Bidder: A person or entity who submits a bid.

Furnish: This term is used to mean supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation and similar operations.

Install: The term is used to describe operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

Provide: To furnish and install, complete and ready for the intended use.

2. CONSTRUCTION MANAGER

R.C. Hendrick & Son, Inc. has been selected by the Owner to organize and direct the complete construction of the project and, as such, will act as a representative of the Owner in those matters so designated.

3. BIDDING PROCEDURE

R.C. Hendrick's online Plan Room is the official location for all bidding documents. **It is each bidder's responsibility to ensure that they have viewed all addenda posted to the Plan Room.** Addendums will be posted no later than 12:00 Noon on the day before the bid is due.

Bidders are to bid COMPLETE Bid Categories only. Bids for partial categories or noting any exceptions may cause your bid to be rejected. If you feel that something is part of your category that should not be included, please submit a Pre-Bid RFI.

Bidders shall include all work noted in the Bid Category Description as well as General Bid Category Notes which apply to ALL Categories.

Each Bidder by submitting this Bid to the Owner represents that they have read and understand the Bidding Documents. Each bidder also represents that they have made a site inspection, familiarized themselves with the local conditions under which the work is to be performed, and have correlated observations with requirements of the Bidding Documents.

Bids shall be submitted in TRIPLICATE. (1) One Original and (2) Two Copies of the Bid Form are required. Fill in ALL blanks on the bid form. Information must be typed or in ink. Express sums in both words and figures. The amount in words will govern in case of a discrepancy. The signer of the bid must initial all interlineations, alterations an erasures.

Enclose the bid and other documents required in a sealed envelope. If the Bid is sent by mail, enclose the sealed envelope in a separate mailing envelope with "Sealed Bid Enclosed" printed on the envelope.

Address the envelope to the party receiving the bids and state project name, the bidder's name and address, and the designated Bid Category # for which the bid is submitted on the outside of the envelope. If you are bidding on more than one Bid Category, each bid must be in its own **clearly marked** envelope.

Bids will be **PUBLICLY** opened approximately (15) fifteen minutes after the deadline to submit bids. Only properly identified bids received on time will be opened.

4. COMBINED BIDS

If you intend on offering a discount as part of a Combined Bid, you MUST submit a base bid in each category and each category MUST be in a separate envelope. The Combined Bid must be entered on at least one Bid Form submitted by the bidder.

5. ALTERNATES

Alternates are listed on the Bid Form and are described in further detail in the Architectural Specification. Each bidder should review all Alternates and determine if what is described in the Specification and shown on the Drawings causes and addition or deduction to their Base Bid. Bidders shall indicate on the Bid Form if the Alternate is an ADD or DEDUCT to the Base Bid and indicate the costs associated. If the Alternate does not affect your scope of work, enter "No Change" in the space provided. The Owner will have the right to accept Alternates in any order or combination and to determine the low bidder on the basis of the sum of the base bid and the accepted Alternate.

6. VOLUNTARY ALTERNATES

The bidder may submit voluntary alternates with their bid. Voluntary Alternates are changes in scope or a specification. Voluntary alternates shall be listed in the appropriate space on the Bid Form. If additional pages are necessary, attach them to the end of the Bid Form on your company letterhead. Voluntary alternates will be reviewed after the award of a contract and the Owner reserves the right to accept or reject any Voluntary Alternate.

7. QUESTIONS AND DISCREPENCIES

Notify the Construction Manager at least five (5) days prior to bid of ambiguities, inconsistencies, or error discovered upon examination of the Bidding Documents, site or local conditions. Submit requests for clarification or interpretation of the Bidding Documents in writing. Interpretation, correction, or change of the Bidding Documents will be made by Addendum, all other forms will be non-binding. Questions should be EMAILED to the Project Manager listed in the R.C. Hendrick Online Plan Room.

8. SUBSTITUTIONS

The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality. Pre-Bid substitution requests must be submitted in writing and received by the CM at least ten (10) days prior to bid date. The burden of proof of the merit of the proposed substitute is upon the proposer. The Owner's decision of acceptance or rejection of a proposed substitution will be final.

Requests for substitutions shall include:

1. The name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cut-sheets, performance, test data and other information necessary for an evaluation.
2. A statement setting forth any changes in other materials, equipment, other work that incorporation of the substitute would require, shall be included.

9. MODIFICATION OR WITHDRAWAL OF A BID

A bid may not be modified or withdrawn following the time and date designated for the receipt of bids. Prior to the time and date designated for receipt of bids, a submitted bid may be withdrawn by notice to the party receiving bids at the place designated for receipt of bids. Notice shall be in writing over the signature of the bidder or in person. Withdrawal notice shall be submitted by mail, telegram, or fax postmarked on or before the date and time for receipt of bids. Withdrawn bids may be resubmitted up to the time designated for the receipt of bids.

10. OWNER'S RESERVATION OF RIGHTS

The Owner reserves the right to reject any, part of any or all bids and to waive all informalities in the bidding procedures. The Owner reserves the right to reject any bid when Bidder fails to submit data required by the Bidding Documents, or if the bid is submitted incomplete or irregular. No telephonic, telegraphic, email, fax bids or modification to a submitted bid will be received or considered by the Owner.

The Owner will have the right to accept Alternates in any order or combination and to determine the low bidder on the basis of the sum of the base bid and the accepted Alternate.

It is the Owner's intent to award a contract to the lowest responsible and competent bidder provided the bid has been submitted in accordance with the requirements of the bidding documents and does not exceed the funds available for construction.

The Owner reserves the right to cancel the project and contract at any point. The contractor will be reimbursed for work performed up to cancellation based upon the amount of work completed.

11. SUBSURFACE MATERIALS AND SOIL BORINGS

Contractors may review test-boring data if it is available. Soil Boring data will be available either as a part of the specification or will be available as a separate file in the Electronic Plan Room. The Owner, CM, or Architect as part of Contract Drawings or Specification does not guarantee its accuracy or completeness. Contractor shall assume all responsibility in excavating for this project and shall not rely on subsurface information obtained for CM. Bidders shall make their own investigation of existing subsurface conditions; neither Owner, CM, nor Architect will be responsible in any way for additional compensation for excavation work performed under the contract due to Contractor's assumptions based on subsoil data prepared solely for Owner's and Architect's use.

12. BONDS

Bid Bond

Each bid which exceeds $50,000 must be submitted with an attached certified check, money order, or a bid bond from a surety company approved to do business in the State of Michigan, payable to the **Owner** in an amount not less than 5% of the base bid sum of the work.

Performance Bond & Labor and Material Payment Bond

Prior to the execution of the contract, furnish bonds covering the faithful performance of the contract and the payment of all obligations arising there under. Include cost of bonds in the base bid. The bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of their power of attorney.

13. POST BID INFORMATION

The Bidder shall within seven (7) days of notification of selection for the award of the Contract for the work, submit the following information.

A. Designation of the Work to be performed by the Bidder with his own forces.
B. Proprietary names and the suppliers of principal items or systems of materials and equipment proposed for the Work.
C. List of names of the subcontractors or other persons or entities (including those who are to furnish materials or equipment fabricated to the special design) proposed for the principal portions of the Work.
D. A list of proposed job site staff and home office staff directly involved with this Project. Indicate the qualifications, pay rates, titles, responsibilities, and duties of each person.
E. Certificates evidencing insurance coverage in the amounts and types specified.
F. An interim construction schedule in a bar graph format.
G. A completed Schedule of Values in the format provided by the Owner.

The Bidder will be required to establish to the satisfaction of the Owner, the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

Prior to the award of the Contract, the Bidder will be notified in writing. If the Owner has reasonable objection to any proposed person or entity, the Bidder may at his option, (1) withdraw his bid or (2) submit an acceptable substitute person or entity with an adjustment in cost occasioned by such substitution. The Owner may at his discretion, accept the adjusted bid price or disqualify the Bidder.

The Owner reserves the right to request financial statements from the bidder before the award of a contract.

14. PRE-AWARD INTERVIEW

The selected Contractor as determined by the Owner will be required to attend a pre-contract award interview at the job site office of R.C. Hendrick & Son, Inc. for the purpose of reviewing the submitted bid for compliance with specified products, methods of installation, warranties, general job procedures, post bid information and related items.

Meeting minutes of the pre-contract interview will be taken by a representative of R.C. Hendrick & Son, Inc. Before concluding the interview, the minutes will be signed by those in attendance.

15. TAXES

Each bidder shall include in their proposal, and agree to pay, all fees and taxes including Sales and Use which they may be required to pay in connection with the performance of the contract. Also, the bidder includes and agrees to pay for all contributions to unemployment compensation, health and welfare, appropriate benefits, or other purposes now or hereafter during the term of the contract and the Owner and Construction Manager shall not be liable for any additional charges.

16. PREVAILING WAGES

Prevailing wages will be a requirement of the Owner on this project.

17. INDEMNIFICATION AND GENERAL LIABILITY INSURANCE

Each trade contractor shall agree to indemnify and hold harmless the Owner, Architect and R.C. Hendrick from and against any and all general liability claims whatsoever arising out of or occurring during and occasioned directly or indirectly by it's negligence or fault. Prior to entering into a contract, each trade contractor shall provide evidence satisfactory to the Owner, Architect and R.C. Hendrick of adequate general liability insurance coverage which names the Owner, Architect and R.C. Hendrick as additional insured. Each trade contractor shall also provide evidence of Worker's Compensation Insurance in the amounts required by the State of Michigan.

18. LOCAL PRODUCTS

All prime bidders, subcontractors and suppliers shall utilize products that are local to the region or State whenever possible where price, quality and performance are equal to or better than non-local products.

19. MINORITY SUBCONTRACTORS

Bidders are encouraged to use the services of minority subcontractors if possible in the pursuance of this project.

20. NON-COLLUSION CLAUSE

By submitting and signing the proposal form, the bidder declares that neither the bidding firm nor agents of the bidding firm or any other members of the proposed team have entered into any collusion or agreement concerning any aspect of the proposal.

21. CONSTRUCTION DOCUMENT RESPONSIBILITIES

All bidders are responsible for the COMPLETE set of drawings and specifications including the CM Issued Front-End, Technical Specifications (Architectural, Mechanical, and Electrical), Drawings (Civil, Structural, Architectural, Mechanical, Electrical, etc.). Bidders are to familiarize themselves with the work of other trades and participate in the coordination of work activities.

All bidders are to include, in their entirety, the work and instructions described in Division 0 – "Bidding and Contract Requirements" and Division 1 – "General Requirements."

22. WARRANTY

All work shall be guaranteed for a period of twelve (12) months from the date of substantial completion of the entire Bid Package unless more specifically stated in the contract documents. All service during this 12-month period shall be rendered without charge to the Owner. This 12-month warranty does not replace any longer warranties required by the specification.

23. SITE VISIT

All contractors are required to visit the site to familiarize themselves with existing conditions either through the Pre-Bid Conference or through a visit you have scheduled with R.C. Hendrick. Contractors shall not visit or walk through the site without permission from R.C. Hendrick.

24. FORMAT OF ELECTRONIC SUBMITTALS

When submitting information electronically all contractors shall use the Portable Document Format (.pdf) for all email attachments. Forms and requests that are submitted in a different format may be rejected resulting in delays to the schedule and payments.

25. ADDITIONAL SETS OF DRAWINGS AND SPECS

The Owner will not furnish additional sets to the successful bidder(s). Contractors will need to purchase or reproduce additional sets of plans and specifications at their own expense.

END OF SECTION 00 2000

SECTION 00 2200

BID CATEGORY GENERAL NOTES

The following are General Notes that apply to all bid categories.

1. **All bid categories are to include all sections in Division 0 and Division 1 in their entirety.**

2. Full compliance with all the safety regulations and requirements of Federal OSHA, MIOSHA, State Authorities, Local Authorities and the Construction Manager. Failure to do so will cause this contractor to be removed from the site. (Hard Hats and Work Boots must be worn at all times.)

3. Recycling of demolished materials by the Contractor and Subcontractor is encouraged provided that the materials are not marked on the drawings or in the specification to be salvaged and returned to the Owner. Any expected recycling earnings by the Contractor or Subcontractor should be reflected in their bid pricing. Recycled materials are not to be stockpiled and must be removed at least weekly from the site. Individual recycling ("dumpster diving") of demolished materials is not permitted on site.

4. Smoking and use of Drugs or Alcohol on School property is strictly prohibited!

5. The maximum allowable markup on Changes in the Work shall be eleven percent (11%) which includes overhead, profit, estimating expenses, other office expense, bond and insurance costs.

6. Each Contractor shall furnish and maintain a trash receptacle, clearly marked with their company name in the vicinity of every work area for their daily use.

7. Contractor and Employee name shall be placed on all hard hats.

8. Drinking water is the responsibility of contractors for their crews.

9. Contractors are required to perform daily and weekly cleanup as defined in Specification Section 017100. This to include proper dust control as generated by their construction activities. Dumpsters provided by owner. No concrete, wood pallets, cardboard, or masonry.

10. **Contact "Miss Dig" three days prior to any excavations**.

11. All contractors are to cooperate with testing agencies hired by the owner. This to include advance notification to the construction manager of activities requiring testing. (Compaction, soil bearing, concrete, steel, etc.) Additional costs associated with failed tests will be passed on to the contractor whose work did not pass.

12. This project will require permits and inspections from the City of Clawson except for Fire inspection. Fire inspection will be required by the Bureau of Fire Services. Contractors shall pull permits and schedule inspections as required by the governing authority.

13. Each contractor is responsible for all layout and field dimensions associated with their work.

14. Contractors shall remove mud and debris from streets and walks as a result of their work activities and deliveries.

15. Fill out and turn in a Daily Report form every day as well as a weekly "tool box talk."

16. Provide all start-up documents to R.C. Hendrick & Son, Inc. within 10 working days from receipt of Notice to Proceed. Startup documents to include signed contracts, Schedule of Values, Certificate of Insurance, Shop Drawings and Submittals, Contractors Safety Program and Current MSDS Files.

17. Contractors are to review all drawings & notes, including civil, architectural, structural, mechanical and electrical, and include all work as defined in their respective bid category.

18. Include sales tax and bond premiums in base bids.

19. Contractors are to put forth their best effort to protect existing finishes and newly installed products from damage.

20. Provide all lifting, hoisting, scaffolding, etc. as required for the full installation of your work. Schedule deliveries during normal working hours.

21. Contractors **must have foreman** attend weekly job progress meetings while on site and when requested by R.C. Hendrick & Son, Inc.

22. Contractor-supplied materials shall be stored in contractor provided storage units unless arrangements are made with the Construction Manager in advance.

23. R.C. Hendrick & Son, Inc. **will not** unload materials for any contractor.

24. All contractors are to participate in keeping the site secure at the end of each workday. Contractors are to shut windows/doors and lock gates at the end of each workday.

25. Contractors shall provide snow and ice removal as required for their work.

26. All openings made by contractors shall be covered and maintained by the contractor creating the opening until permanent finishes are installed.

27. Firestopping of openings in walls shall be done by the contractor who created the opening.

28. The owner and construction manager shall obtain and pay for a building permit only.

29. This project requires the payment of prevailing wages.

END OF SECTION 00 2200

BID CATEGORY #1

EARTHWORK / SITE UTILITIES
Projects 1, 3, 4, 5 and 6

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

31 1000	Site Clearing
31 1012	Fine Grading
31 1018	Soil Erosion Control
31 2000	Earthwork
31 2001	Earth Moving
31 3219	Geotextile Fabric
32 1124	Aggregate Base Course
32 9200	Turfs and Grasses
32 9227	General Lawn Restoration
33 4100	Storm Sewers, Under Drains and Drainage Systems
33 4413	Manholes, Catch Basins and Similar Structures
33 4605	Subdrainage System, Flat Draintile
33 4610	Subdrainage Systems, Peastone

Bid Category Notes (Including, but not limited to):

1. Protect all open excavations.
2. Keep site graded and accessible to contractors.
3. All demolition debris is to be hauled off site and disposed of properly.
4. Include all site demolition, concrete removal, saw cutting, asphalt removal, asphalt crushing or milling, trees, shrubs, etc. as indicated or required for new Sitework. This to include all site demolition up to face of buildings. Building demolition is by others.
5. Install storm, sanitary and domestic water piping within five (5) feet of building entrance point. Final connections shall be coordinated with mechanical contractor.
6. Furnish, install and maintain all soil erosion measures for the duration of the project. Obtain and pay for soil erosion permit and ***provide*** a storm water operator to review soil erosion measures as required. SESC book shall be kept on site and filled out weekly and/or after each event as required by the soil erosion permit.
7. Provide all excavation, shoring, grading, compaction, backfill, berms and off-site fill to final subgrade elevations as shown or specified, including backfill required around building foundations, foundation walls, retaining walls, sidewalks, drives, equipment pads, light pole bases, etc. This to include rough and final grading to +/- .10 foot below bottom of finish paving. Provide extra material for fine grading by others as needed.

8. Provide all dewatering (ground and rain water) as necessary to perform the work within this package.
9. Perform Chlorination of installed water piping per code and specifications ***IF*** required.
10. Perform revisions to water main as required. Provide unit pricing as specified.
11. Obtain and pay for all required permits, bonds, etc as necessary to perform the work within this bid category.
12. No changes in grade or line are allowed without approval of the Construction Manager or Architect/Engineer.
13. Furnish and install all sleeves passing under walks, driveways, etc.
14. Coordinate and cooperate with testing firm hired by the owner to ensure proper backfill procedures to meet bearing capacity as shown or specified.
15. **Provide dust/mud control throughout project duration. This may require sweeping and/or vacuuming of drives and/or walks as needed. This may also require the use of a water truck to keep dust to a minimum.**
16. **Area roadways are to be kept clean of dirt and debris generated by construction activity.**
17. Provide all barricading as required to meet state and local codes during tie in of new work to existing roadways and sidewalks. Barricades shall be left in place until completion of asphalt.
18. Provide periodic compaction of owner supplied dumpsters at the request of the CM.
19. Provide all saw cuts for tie in to existing roadways and sidewalks.
20. Remove and salvage signs and posts within construction limits and place in location as directed by construction manager.
21. Provide crushing, milling and reshaping of existing asphalt to +/- .10ft as called for on plans. Final grading is by others.
22. Temporary fencing will be installed by owner, but must be maintained by this contractor.
23. Provide seeding of disturbed areas as specified on plans.
24. Maintain lawn areas until final acceptance as called for in plans and specifications.
25. Include layout, excavation and backfill for turf anchors.
26. Must meet specifications for sub base for turf installation.
27. Include jetting/cleaning of existing storm piping as shown on drawings.
28. Include all sub base work/drainage for Tennis Court installation.

Work By Others (Close coordination will be required)

1. Synthetic turf field
2. Concrete work

BID CATEGORY #2

BITUMINOUS PAVING,
Projects 1, 3 and 6

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

03 1123	Aggregate Drainage Layer
32 1216	Hot Mix Asphalt Concrete Paving
32 1218	Plant Mix Bituminous Paving
32 1415	Pavement Markings

Bid Category Notes (Including, but not limited to):

1. If necessary, broom clean asphalt base coat prior to placement of finish coat.
2. Fine grade aggregate base prior to installation of base course.
3. Include all pavement markings.
4. Clean up loose asphalt particles upon completion of each course of asphalt placement.
5. Provide layout as required.
6. Include all barricading and flagging as necessary.

Work by Others (Close coordination will be required)

1. Asphalt for Tennis Courts by Bid Category 5

BID CATEGORY #3

CONCRETE
Projects 1, 3, 4, 5, and 6

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

03 3000	Cast In Place Concrete
03 3010	Portland Cement Concrete
03 3499	Precast Concrete Storage Buildings
32 0118	Sealing of Joints in Rigid Pavement
32 1313	Cement Concrete Pavements
32 1373	Concrete Paving Joint Sealants

Bid Category Notes (Including, but not limited to):

1. Furnish, form, and install all concrete for footings, foundations, slabs on grade, elevated decks, sidewalks, stoops, light poles, etc. Coordinate with other trades.
2. Install concrete apron around catch basins as shown or specified.
3. Excavation, compaction, and backfill to +/- .10ft provided by Sitework contractor.
4. Final grading by this contractor.
5. Furnish and install all exterior concrete pavements as shown or specified.
6. Install concrete curb and gutter as shown or specified.
7. Provide proper curing and sealing of concrete as shown or specified. Include sealer for all exposed concrete floors as specified.
8. Provide sawcutting of concrete curbs and walks as required for tie-ins.
9. This bid category to work with sitework contractor to layout all building foundations to ensure proper excavation of footings.
10. Provide and install all reinforcing as shown or specified. Provide proper rebar protection as required by MIOSHA.
11. Furnish and install all MDOT parking lot signage as shown on drawings. To include handicap signs, stop signs, directional signage, etc.
12. This contractor to provide floor and wall scraping of concrete "splatter" from the installation of their work. Re-check/re-scrape after installation of block filler and prior to placement of sealers on exposed CMU surfaces.
13. Install pipe bollards ***if*** shown.
14. Include all concrete for turf anchor system
15. Include trough drain installation at Tennis Courts
16. Mudjacking of existing sidewalks by this bid category.

BID CATEGORY #4

SYNTHETIC TURF
Project 4

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

32 1813	Synthetic Turf
06 1050	Turf Anchor

Bid Category Notes (Including, but not limited to):

1. Wood turf anchor by this bid category.
2. Provide layout as required.

Work by Others (Close coordination will be required)

1. Concrete work for turf anchor

BID CATEGORY #5

TENNIS COURTS
Project 3

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

11 6826	Net Tension System
32 1218	Hot Mix Asphalt
32 1834	Acrylic Tennis Court Surface

Bid Category Notes (Including, but not limited to)

1. Include all work for complete tennis courts. Including, but not limited to asphalt, court surface, nets, posts and striping.

Work by Others (Close coordination will be required)

1. Fencing by Bid Category 8
2. Sub base and drainage for courts by Bid Category 1
3. Trough drain by bid category 3

BID CATEGORY #6

SPORTS/GYM EQUIPMENT
Projects 1, 2, and 4

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

11 6633	Gymnasium Equipment
11 6836	Soccer Goal (Portable)
11 6842	Protective Netting

Bid Category Notes (Including, but not limited to):

1. Provide and install gymnasium equipment complete.
2. Protect existing finishes during installation.
3. Provide owner training.

Work by Others (Close coordination will be required)

1. Net tension system by Bid Category 5

BID CATEGORY #7

GENERAL TRADES/SELECTIVE DEMOLITION
Projects 1, 2, 3, 4, 5, 6, and 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

02 4110	Salvage and Relocation
02 4113	Demolition
02 4119	Selective Structure Demolition
03 3499	Precast Concrete Storage Buildings
06 1000	Rough Carpentry
06 1600	Sheathing
06 4023	Interior Architectural Woodwork (Custom Built Millwork)
08 1113	Hollow Metal Doors and Frames
08 1416	Flush Wood Doors
08 3113	Access Doors and Frames
08 7200	Door Hardware
10 2213	Toilet Compartments
10 2800	Toilet and Bath Accessories

Bid Category Notes (Including, but not limited to):

1. Furnish all layout for this bid category.
2. Provide and install all exterior and interior rough and finish carpentry items including frames, nailers, blocking, plywood sheathing, etc.
3. This contractor shall pay all costs associated with removal of selective demo items from the site. Contractor shall consult with CM for equipment/materials to be turned over to owner. A metal dumpster will be placed on site by the district. All metal demolition items to be placed in this dumpster.
4. Furnish all embedded anchors and bolts for attachment of carpentry to masonry or concrete.
5. Furnish all fasteners necessary for all work included in this bid category.
6. Provide wood or sheet metal blocking in gypsum walls for toilet partitions, markerboards/tackboards, casework, and any miscellaneous accessories requiring such.
7. Provide and install all door hardware for doors supplied by this bid category.
8. Provide, install and maintain a minimum of 1 temporary fire extinguisher every 3000sf for new construction areas. These to be centrally located and visibly marked per MIOSHA standards.
9. Provide and install all hollow metal doorframes, hollow metal doors, and wood doors.
10. Provide and install bathroom partitions, toilet and bath accessories, and solid polymer surfacing.
11. Custom millwork to be pre-finished prior to arrival on site.
12. Provide primer touch up and cleaning of hollow metal frames prior to painting.
13. Provide and install one layer of ice/water shield over plywood at metal roof areas.
14. Base plate grouting by this bid category

15. Stair demo at Project 7 by this Bid Category. Coordinate with Bid Category 24
16. Storage building (prefab) by this Bid Category

BID CATEGORY #8

FENCING
Projects 1, 3, 4, and 6

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

32 3100 Chain Link Fence

Bid Category Notes (Including, but not limited to):

1. Include all fencing at Tennis Courts
2. Include operator and installation for powered gate
3. Provide cleanup of spoils from post installation
4. Include all layout

Work by Others (Close coordination will be required)

1. Electrical
2. Protective Netting at Tennis Courts

BID CATEGORY #9

MASONRY
Projects 3, 4, and 5

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

04 0513	Mortar
04 2000	Unit Masonry

Bid Category Notes (Including, but not limited to):

1. Receive, unload and install all metal embedded lintels, anchors, bearing plates, etc. as supplied by others and installed in masonry.
2. Furnish and install brick, glass block, block, stone veneer assemblies, concrete masonry units, architectural precast concrete, through wall flashing, anchors, weeps, vents and other accessories as necessary for a complete system.
3. Furnish and install horizontal and vertical wall reinforcement where shown or specified.
4. Provide shop drawings showing placement of reinforcing steel.
5. Furnish and install all insulation associated with masonry and/or cast stone including but not limited to safing at masonry cavities and where masonry walls extend to deck.
6. Include all UL Listed firestopping and fireproofing of masonry walls during erection. Fire rating of openings created after installation of masonry is the responsibility of the contractor creating the opening.
7. Install anchor bolts, bearing plates and miscellaneous items in masonry as shown or specified and supplied by other trades.
8. This contractor is to thoroughly clean all concrete floors and masonry walls of excess mortar prior to painting and floor finishes.
9. Install openings for recessed equipment as shown or specified.
10. This contractor to re-scrape masonry walls after application of block filler and prior to placement of finish paint or ceramic tile.
11. This bid category shall provide a dumpster or trailer for removal of all masonry materials including CMU. Materials shall not be left on site in piles.
12. In order to keep job progressing, this bid category will be responsible for maintaining rough opening dimensions at window and door locations. This contractor will be responsible for any costs incurred by other contractors due to variances in rough opening sizes of !/2" or more.
13. This bid category to provide dust control for their activities; cutting, mixing and driving equipment around the site. Dust to be kept minimized at all times!
14. Provide all toothing of masonry openings as required for installation of new openings or as needed for a smooth transition.
15. Provide grouting of hollow metal frames.
16. Coordinate with Mechanical trades for proper infill at UV's and other items.
17. This Bid Category to provide all lintels.

BID CATEGORY #10

METALS
Projects 4 and 5

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

05 4000	Cold-Formed Metal Framing
05 5000	Metal Fabrications

Bid Category Notes (Including, but not limited to):

1. Contractor is to follow proper safety procedures at all times. Contractor is to meet MIOSHA requirements for safety at all times.
2. Provide structural steel shop drawings within 4 weeks of notice to proceed.
3. Provide detailed layouts of embedded anchors and bearing plates to C.M. for use by other trades.
4. Furnish all inserts, bearing plates, lintels, anchor bolts and miscellaneous steel embedded in concrete and masonry.
5. This contractor to check all bearing plate elevations and anchor bolt layouts one week prior to delivery and erection of structural steel, bar joists and deck. Any irregularities are to be reported to the CM immediately for correction.
6. Review all drawings and include all misc. steel as shown or specified. Review architectural, mechanical and electrical drawings and include misc. steel lintels and framing required for ductwork passing through masonry walls and floors.
7. All steel being delivered is to be rested on proper dunnage to keep free from mud and debris. All mud and debris is to be removed from steel prior to paint or fireproofing.
8. Factory "oil/dirt" is to be removed from all steel shown to receive paint or fireproofing.
9. Touch up primer on all field welds as specified.
10. Provide and install all structural framing as required for the installation of mechanical and electrical units.
11. Provide galvanizing as shown or specified.
12. Provide "Field Use" shop drawings immediately after "Reviewed" shop drawings are received from CM.
13. Provide attachments on all columns, lintels, and beams as required to attach masonry anchors as shown or specified.
14. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. This information to be provided to CM prior to workers arriving on site.
15. Provide pipe bollards ***if*** shown.
16. Review roof demolition drawings and include deck infill as required.

BID CATEGORY #11

ROOFING-1
Projects 1, 2

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 5356	Duro-Last Mechanically Fastened Membrane Roofing System
07 6200	Sheet Metal Flashing and Trim
07 7100	Roof Specialties

Bid Category Notes (Including, but not limited to):

1. Contractor is to meet MIOSHA requirements for safety at all times during demolition and installation of roof.
2. This contractor is responsible for all costs associated with roof demolition including removal of materials from site. **Contractor is responsible for making sure building is kept dry at all times.**
3. **Provide safety enclosures over openings created by removal of equipment. Work with electricians and mechanical contractor to secure openings and maintain water tight.**
4. Contractor to provide CM with detailed plan for roof removal and replacement. This plan to include method, placement of materials, placement of equipment, safety procedures, etc.
5. Provide sealants as required for your work.
6. Provide and install all flashing and related sheet metal flashing as it pertains to the membrane roofing for a complete roof system.
7. Review architectural, mechanical, electrical plans for penetrations. Provide flashing as required around these penetrations for a complete roof system.
8. Provide and install all roof related expansions as shown, specified, or required by the manufacturer for a complete roof system.
9. This contractor to supply and install any items not shown or specified but required by the manufacturer for a complete roof system. Including and wood blocking not shown or specified.
10. Contractor shall provide and install proper length screws to ensure screws do not penetrate lower rib of deck in exposed areas.
11. Furnish any reglet flashings to Mason for installation in new walls. Roofer to supply and install all reglet flashings in existing walls as shown or specified.
12. Provide and install all roof insulation as shown or specified.
13. Receive, protect and install acoustical batts supplied by Metals contractor.
14. Provide protection as required in order to prevent damage to surrounding materials during roof installation.
15. Provide temporary membrane enclosure over all curbed mechanical openings prior to setting of equipment. Removal and disposal of this material is by the mechanical contractor.
16. Coordinate with mechanical and electrical contractor to flash all roof curbs and electrical penetrations.
17. Provide all hoisting and required material handling for this bid category.

BID CATEGORY #12

ROOFING-2
Projects 3,4,5

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 5356	Duro-Last Mechanically Fastened Membrane Roofing System
07 6200	Sheet Metal Flashing and Trim
07 7100	Roof Specialties

Bid Category Notes (Including, but not limited to):

1. Contractor is to meet MIOSHA requirements for safety at all times during demolition and installation of roof.
2. This contractor is responsible for all costs associated with roof demolition including removal of materials from site. **Contractor is responsible for making sure building is kept dry at all times.**
3. **Provide safety enclosures over openings created by removal of equipment. Work with electricians and mechanical contractor to secure openings and maintain water tight.**
4. Contractor to provide CM with detailed plan for roof removal and replacement. This plan to include method, placement of materials, placement of equipment, safety procedures, etc.
5. Provide sealants as required for your work.
6. Provide and install all flashing and related sheet metal flashing as it pertains to the membrane roofing for a complete roof system.
7. Review architectural, mechanical, electrical plans for penetrations. Provide flashing as required around these penetrations for a complete roof system.
8. Provide and install all roof related expansions as shown, specified, or required by the manufacturer for a complete roof system.
9. This contractor to supply and install any items not shown or specified but required by the manufacturer for a complete roof system. Including and wood blocking not shown or specified.
10. Contractor shall provide and install proper length screws to ensure screws do not penetrate lower rib of deck in exposed areas.
11. Furnish any reglet flashings to Mason for installation in new walls. Roofer to supply and install all reglet flashings in existing walls as shown or specified.
12. Provide and install all roof insulation as shown or specified.
13. Receive, protect and install acoustical batts supplied by Metals contractor.
14. Provide protection as required in order to prevent damage to surrounding materials during roof installation.
15. Provide temporary membrane enclosure over all curbed mechanical openings prior to setting of equipment. Removal and disposal of this material is by the mechanical contractor.
16. Coordinate with mechanical and electrical contractor to flash all roof curbs and electrical penetrations.
17. Provide all hoisting and required material handling for this bid category.

BID CATEGORY #13

ROOFING/METAL ROOF PANELS
Project 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 2100	Thermal Insulation
07 4113	Metal Roof Panels
07 6200	Sheet Metal Flashing and Trim
07 7100	Roof Specialties

Bid Category Notes (Including, but not limited to):

1. Contractor is to meet MIOSHA requirements for safety at all times during demolition and installation of roof.
2. This contractor is responsible for all costs associated with roof demolition including removal of materials from site. **Contractor is responsible for making sure building is kept dry at all times.**
3. **Provide safety enclosures over openings created by removal of equipment. Work with electricians and mechanical contractor to secure openings and maintain water tight.**
4. Contractor to provide CM with detailed plan for roof removal and replacement. This plan to include method, placement of materials, placement of equipment, safety procedures, etc.
5. Provide sealants as required for your work.
6. Provide and install all flashing and related sheet metal flashing as it pertains to the membrane roofing for a complete roof system.
7. Review architectural, mechanical, electrical plans for penetrations. Provide flashing as required around these penetrations for a complete roof system.
8. Provide and install all roof related expansions as shown, specified, or required by the manufacturer for a complete roof system.
9. This contractor to supply and install any items not shown or specified but required by the manufacturer for a complete roof system. Including and wood blocking not shown or specified.
10. Contractor shall provide and install proper length screws to ensure screws do not penetrate lower rib of deck in exposed areas.
11. Furnish any reglet flashings to Mason for installation in new walls. Roofer to supply and install all reglet flashings in existing walls as shown or specified.
12. Provide and install all roof insulation as shown or specified.
13. Provide protection as required in order to prevent damage to surrounding materials during roof installation.
14. Provide all hoisting and required material handling for this bid category.
15. Provide complete metal roof system
16. Include all trim/coping metals.

BID CATEGORY #14

DRYWALL / ACOUSTICAL
Projects 1, 2, 3, 4, 5, and 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

05 5000	Metal Fabrications
07 2100	Thermal Insulation
07 8413	Penetration Firestopping (Firestopping and Smoke Stopping Systems)
09 2900	Gypsum Board
09 5123	Acoustical Tile Ceilings
09 8400	Acoustic Room Components

Bid Category Notes (Including, but not limited to):

1. Provide all hoisting, lifting and storage of materials.
2. Furnish and install all metal framing, drywall, and insulation.
3. Provide minor touch up of drywall after installation of final finishes including casework, switch/receptacle covers and mechanical items.
4. Provide minor touch up of drywall finishes following primer application and prior to finish painting.
5. Install access panels in acoustical soffits and/or walls as needed and supplied by other trades.
6. Provide and install drywall soffits as shown or specified.
7. Provide tile to other trades for installation of their work. (i.e. sprinkler heads, cameras, smoke detectors, lighting, etc.)
8. Provide and install ceiling grid system.
9. **Remove, salvage, and replace 10% of total ceiling system for installation and removal of ceilings as required for contractors to perform their work. Removal to be coordinated with CM.**
10. **Provide and install sound absorption panels as shown and specified.**
11. Include Project 1 – Plaster soffit replacement

BID CATEGORY #15

PAINTING-1
Projects 1, 2, 5 and 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 9200	Joint Sealants
09 9100	Painting

Bid Category Notes (Including, but not limited to):

1. Include painting of exposed steel, mechanical, electrical, etc. as shown or specified.
2. Include all interior and exterior painting as shown or specified.
3. Include "minor" scraping of masonry walls.
4. Provide touch-up as needed upon completion of remaining finishes (casework, carpentry, lockers, fixtures, etc.)
5. Provide and install filler at nail holes of installed window trims on interior finished doors if required.
6. Provide finishing of all wood trim and millwork not furnished pre-finished.
7. Protect all surfaces not requiring painting.

Work by Others (Close coordination will be required)

1. Epoxy flooring by Bid Category 18

BID CATEGORY #16

PAINTING-2
Projects 3 and 4

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 9200	Joint Sealants
09 9100	Painting

Bid Category Notes (Including, but not limited to):

1. Include painting of exposed steel, mechanical, electrical, etc. as shown or specified.
2. Include all interior and exterior painting as shown or specified.
3. Include "minor" scraping of masonry walls.
4. Provide touch-up as needed upon completion of remaining finishes (casework, carpentry, lockers, fixtures, etc.)
5. Provide and install filler at nail holes of installed window trims on interior finished doors if required.
6. Provide finishing of all wood trim and millwork not furnished pre-finished.
7. Protect all surfaces not requiring painting.

Work by Others (Close coordination will be required)

1. Epoxy flooring by Bid Category 18

BID CATEGORY #17

ALUMINUM STOREFRONTS / GLAZING
Projects 4, 5, 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

02 4113	Demolition
07 9200	Joint Sealants
08 2113	Flush Fiberglass Reinforced Polyester (FRP Doors)
08 4113	Aluminum-Framed Entrances and Storefronts
08 4500	Translucent Wall and Roof Assemblies
08 7200	Door Hardware
08 8000	Glazing (Glass)

Bid Category Notes (Including, but not limited to):

1. Furnish and install all aluminum windows, aluminum entrances, curtain walls and storefronts as shown or specified.
2. Furnish and install all glazing shown or specified.
3. Remove all stickers, labels and excess caulking from glass and frames upon completion.
4. Include all sealants to complete this work, glass to aluminum, aluminum to aluminum, aluminum to adjacent surfaces, interior and exterior
5. Provide and install all door hardware on doors supplied by this bid category. Where automatic door openers are to be installed, provide and install low voltage wiring and controls for a workable system. Automatic door operators to include push pads, door controls, and wiring necessary to make the system operational. Coordinate AC power with electrician.
6. Include all metal angles, clips, fasteners, shims, etc. required for complete installation.
7. Furnish and install aluminum covers, sills, mullions, trim, etc. where aluminum systems about other finishes and/or are shown to incorporate structural members.
8. This contractor shall provide shop drawings within 20 calendar days of Notice to Proceed.
9. Provide all field measurements for your work.
10. Provide all hoisting, lifting and storage materials.
11. Furnish and install insulation behind aluminum systems as shown or specified.
12. Include new windows at Press Box
13. To keep buildings weather tight, all demo of related doors and window replacements will be by this bid category.

BID CATEGORY #18

EPOXY FLOORING
Projects 1, 2, 3 and 4

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

09 6710 Epoxy Flooring

Bid Category Notes (Including, but not limited to):

1. Provide all prep for epoxy flooring.
2. Furnish and install epoxy flooring.
3. Provide 1'x1' sample boards for Owner review prior to commencing work.
4. Protect all surfaces not requiring painting.

Work by Others (Close coordination will be required)

1. Epoxy wall painting by 16 and 17

BID CATEGORY #19

PORCELIN/CERAMIC TILE
Projects 2, 3, and 4

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

09 3000 Hard Tile

Bid Category Notes (Including, but not limited to):

1. Furnish and install all transition strips between different floor types.
2. Include floor patching and feathering as required.
3. Provide and install sealer ***if*** required.
4. Protect walls from damage during installation.
5. Provide proper barricading during work activity to reduce possibility of damage to work.
6. Provide surface preparation of floors and walls as needed to ensure a quality, finished product.
7. Provide caulking or control joints as necessary. Verify with manufacturer and architect.
8. Provide mud beds as required.

BID CATEGORY #20

RESILIENT FLOORING/CARPET/SHEET FLOORING-1
Projects 1, 2 and 5

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

09 6519	Resilient Tile Flooring
09 6816	Sheet Carpeting and Tile Carpeting

Bid Category Notes (Including, but not limited to):

1. Furnish and install all transition strips, sheet vinyl caps, etc. between different floor types.
2. Include floor patching and feathering as required.
3. Furnish and install vinyl base and molding accessories in all areas to receive resilient floor tile and carpet and as shown or specified.
4. Provide and install all vinyl base on cabinetry after it is installed.

BID CATEGORY #21

RESILIENT FLOORING/CARPET/SHEET FLOORING-2
Projects 3, 4

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

09 6519	Resilient Tile Flooring
09 6816	Sheet Carpeting and Tile Carpeting

Bid Category Notes (Including, but not limited to):

5. Furnish and install all transition strips, sheet vinyl caps, etc. between different floor types.
6. Include floor patching and feathering as required.
7. Furnish and install vinyl base and molding accessories in all areas to receive resilient floor tile and carpet and as shown or specified.
8. Provide and install all vinyl base on cabinetry after it is installed.

BID CATEGORY #22

WOOD ATHLETIC FLOORING
Project 2

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

09 6467 Wood Floor Refinishing

Bid Category Notes (Including, but not limited to):

1. Include painting of game lines and school logo as shown or specified.
2. Provide and install vinyl perimeter cove base.
3. Provide and install thresholds at doorways and floor transitions.
4. Provide proper dust control during work activities.

BID CATEGORY #23

METAL LOCKERS
Projects 3, 4

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

10 5113 Metal Lockers

Bid Category Notes (Including, but not limited to):

1. Provide, assemble and install lockers as shown or specified.
2. Protect other finishes during installation.
3. Provide all trims required for complete system.

BID CATEGORY #24

BLEACHERS
Projects 4, 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

13 3515 Bleachers Non-Elevated

Bid Category Notes (Including, but not limited to):

1. Cover and protect floors during delivery and installation.
2. Make final power connections. Disconnects will be in place prior to bleacher installation.
3. Provide testing and training to the owner.
4. Perform final cleanup including, but not limited to, dusting of seats and telescoping stands.
5. Include stairs at Press Box

Work by Others

1. Concrete Work
2. Wood stair demo at Press Box

BID CATEGORY #25

MECHANICAL-1
Projects 1, 2 and 5

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 8413	Penetration Firestopping
20 0001	Mechanical Demolition
20 0010	Basic Mechanical Requirements
20 0020	Electrical Requirements for Mechanical Work
22 0053	Identification for Plumbing Piping and Equipment
22 0719	Plumbing Piping Insulation
22 1005	Plumbing Piping
22 3000	Plumbing Equipment
22 4000	Plumbing Fixtures
23 0519	Meters and Gages for HVAC Piping
23 0548	Vibration and Seismic Controls for HVAC Piping and Equipment
23 0553	Identification for HVAC Piping Equipment
23 0593	Testing, Adjusting and Balancing for HVAC
23 0713	Duct Insulation
23 0719	HVAC Piping Insulation
23 0913	Instrumentation and Control Devices for HVAC
23 0925	Direct Digital Control System for HVAC
23 2113	Hydronic Piping
23 2114	Hydronic Specialties
23 2123	Hydronic Pumps
23 2300	Refrigerant Piping
23 2500	HVAC Water Treatment
23 3100	HVAC Ducts and Casings
23 3300	Air Duct Accessories
23 3416	Centrifugal HVAC Fans
23 3423	HVAC Power Ventilators
23 3700	Air Outlets and Inlets
23 7313	Modular Central Station Air Handling Units
23 8101	Terminal Heat Transfer Units
23 8127	Small Split-System Heating and Cooling

Bid Category Notes (Including, but not limited to):

1. Provide all mechanical demolition as show or called for on plans. Contractor shall consult with CM for equipment/materials to be turned over to owner. Provide dumpster as required for demo items.
2. Furnish and install all sleeves in walls, floors, roofs and ceilings that may be required for this Bid Category.
3. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval for the facility.
4. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.
5. Coordinate delivery and storage of material with the Construction Manager prior to delivery. Remove all cardboard from site and recycle or discard.
6. Furnish and install caulking and sealers around the plumbing fixtures and pipe.
7. Provide and install pipe identification and other required identification or signage related to this Bid Category.
8. **This Bid Category is also responsible for Mechanical Requirements as shown on the Architectural, Fire Protection and Electrical Drawings.**
9. Provide a complete mechanical system that includes all piping, ductwork, temperature controls, insulation, fixtures, testing, balancing, etc.
10. Furnish and install all louvers related to this bid category as shown or specified.
11. The Mechanical, Fire Protection, and Electrical Contractors will be required to coordinate with each other to accomplish final layout. Any relocation required to coordinate work will be done at no additional cost to the owner. All contractors are required to furnish layout and coordination prints for their work prior to installation.
12. Furnish access panels that may be required but are not shown. To be installed by others.
13. Furnish and install roof drains and overflow drains, including clamping devices.
14. Provide cleaning and testing of all piping systems for the work within this category.
15. Provide and install any/all water meters and backflow preventers for domestic water service as shown, specified, or needed to provide a complete system.
16. Provide a copy of all mechanical and plumbing permits to the CM as soon as applied for and received.
17. Provide MIOSHA approved, weathertight cover at all installed roof curbs and equipment openings until equipment is set.
18. Provide and install all fireproofing of penetrations, piping, ductwork, etc. which are installed in concrete floors, masonry or drywall walls.
19. Remove and re-install mechanical equipment and piping on roof as necessary for new roof installation. Work with roofers to provide a MIOSHA approved cover over openings as required. Roofer to temporarily seal opening as required.

BID CATEGORY #26

MECHANICAL-2
Projects 3, 4 and 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 8413	Penetration Firestopping
20 0001	Mechanical Demolition
20 0010	Basic Mechanical Requirements
20 0020	Electrical Requirements for Mechanical Work
22 0053	Identification for Plumbing Piping and Equipment
22 0719	Plumbing Piping Insulation
22 1005	Plumbing Piping
22 3000	Plumbing Equipment
22 4000	Plumbing Fixtures
23 0519	Meters and Gages for HVAC Piping
23 0548	Vibration and Seismic Controls for HVAC Piping and Equipment
23 0553	Identification for HVAC Piping Equipment
23 0593	Testing, Adjusting and Balancing for HVAC
23 0713	Duct Insulation
23 0719	HVAC Piping Insulation
23 0913	Instrumentation and Control Devices for HVAC
23 0925	Direct Digital Control System for HVAC
23 2113	Hydronic Piping
23 2114	Hydronic Specialties
23 2123	Hydronic Pumps
23 2300	Refrigerant Piping
23 2500	HVAC Water Treatment
23 3100	HVAC Ducts and Casings
23 3300	Air Duct Accessories
23 3416	Centrifugal HVAC Fans
23 3423	HVAC Power Ventilators
23 3700	Air Outlets and Inlets
23 7313	Modular Central Station Air Handling Units
23 8101	Terminal Heat Transfer Units
23 8127	Small Split-System Heating and Cooling

Bid Category Notes (Including, but not limited to):

1. Provide all mechanical demolition as show or called for on plans. Contractor shall consult with CM for equipment/materials to be turned over to owner. Provide dumpster as required for demo items.
2. Furnish and install all sleeves in walls, floors, roofs and ceilings that may be required for this Bid Category.
3. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval for the facility.
4. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.
5. Coordinate delivery and storage of material with the Construction Manager prior to delivery. Remove all cardboard from site and recycle or discard.
6. Furnish and install caulking and sealers around the plumbing fixtures and pipe.
7. Provide and install pipe identification and other required identification or signage related to this Bid Category.
8. **This Bid Category is also responsible for Mechanical Requirements as shown on the Architectural, Fire Protection and Electrical Drawings.**
9. Provide a complete mechanical system that includes all piping, ductwork, temperature controls, insulation, fixtures, testing, balancing, etc.
10. Furnish and install all louvers related to this bid category as shown or specified.
11. The Mechanical, Fire Protection, and Electrical Contractors will be required to coordinate with each other to accomplish final layout. Any relocation required to coordinate work will be done at no additional cost to the owner. All contractors are required to furnish layout and coordination prints for their work prior to installation.
12. Furnish access panels that may be required but are not shown. To be installed by others.
13. Furnish and install roof drains and overflow drains, including clamping devices.
14. Provide cleaning and testing of all piping systems for the work within this category.
15. Provide and install any/all water meters and backflow preventers for domestic water service as shown, specified, or needed to provide a complete system.
16. Provide a copy of all mechanical and plumbing permits to the CM as soon as applied for and received.
17. Provide MIOSHA approved, weather tight cover at all installed roof curbs and equipment openings until equipment is set.
18. Provide and install all fireproofing of penetrations, piping, ductwork, etc. which are installed in concrete floors, masonry or drywall walls.
19. Remove and re-install mechanical equipment and piping on roof as necessary for new roof installation. Work with roofers to provide a MIOSHA approved cover over openings as required. Roofer to temporarily seal opening as required.
20. This bid category is responsible for the pool pump replacement and sump crock coating.

BID CATEGORY #27

ELECTRICAL-1
Projects 1, 2, 5 and 6

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 8413	Penetration Firestopping
26 0500	Basic Electrical Requirements
26 0501	Minor Electrical Demolition
26 0519	Low Voltage Electrical Power Conductors and Cables
06 0526	Grounding and Bonding for Electrical Systems
26 0529	Hangers and Supports for Electrical Systems
26 0534	Conduit
26 0537	Boxes
26 0553	Identification for Electrical Systems
26 0933	Central Dimming Systems
26 2416	Panelboards
26 2726	Wiring Devices
26 2813	Fuses
26 2818	Enclosed Switches
26 5100	Interior Lighting
26 5600	Exterior Lighting
26 5701	Occupancy Sensors
27 4000	Sound Systems
28 3100	Digital, Addressable Fire Alarm System

Bid Category Notes (Including, but not limited to):

1. Provide all demolition of electrical items as shown or specified. Contractor shall consult with CM for equipment/materials to be turned over to owner. Provide dumpster as required for demo items.
2. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.
3. **This Bid Category is also responsible for Electrical Requirements as shown on the Architectural, Civil and Mechanical Drawings. Review all drawings prior to bidding.**
4. Coordinate delivery and storage of material with the Construction Manager **prior** to delivery.
5. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval of the facility.
6. Include all cutting and coring of walls, floors ceilings, etc. as required for the installation of this work.

7. Provide a complete electrical system including, but not limited to; all wiring, panelboards, fixtures, fire alarm systems, lighting controls, sound systems, etc.
8. Provide Network / Communication raceways as shown or specified.
9. Furnish access panels required for all electrical items, which require access in inaccessible areas. Access panels to be installed by others.
10. Cleaning and protection of the equipment, fixtures, etc. installed in this work are the responsibility of this subcontractor until accepted by Owner, including those items of equipment, fixtures, etc. furnished by others to this subcontractor for installation.
11. All inspection reports from local, state and federal inspection agencies will be provided to the Construction Manager.
12. Include all connections of power wiring to devices, including equipment, motors, heaters, automatic door openers and strikes (review Architectural and Mechanical Drawings for items not shown on Electrical Drawings).
13. Duct smoke detectors shall be provided and installed by this Bid Category.
14. Provide and install all motor starters, disconnects, etc. as shown or specified.
15. Provide electrician on site upon start up of mechanical units to verify proper rotation and power.
16. Fire Alarm drawings to be submitted to State of Michigan within 3 weeks of notice to proceed.
17. The Fire Protection, Electrical, and Mechanical contractors will be required to coordinate with each other to accomplish final layout. Any relocation required to coordinate work will be done at no additional cost to the owner.
18. Remove and re-install power to mechanical equipment on roof as necessary for new roof installation. Work with roofers to provide a MIOSHA approved cover over openings as required. Roofer to temporarily seal opening as required.

BID CATEGORY #28

ELECTRICAL-2
Projects 3, 4, and 7

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 8413	Penetration Firestopping
26 0500	Basic Electrical Requirements
26 0501	Minor Electrical Demolition
26 0519	Low Voltage Electrical Power Conductors and Cables
06 0526	Grounding and Bonding for Electrical Systems
26 0529	Hangers and Supports for Electrical Systems
26 0534	Conduit
26 0537	Boxes
26 0553	Identification for Electrical Systems
26 0933	Central Dimming Systems
26 2416	Panelboards
26 2726	Wiring Devices
26 2813	Fuses
26 2818	Enclosed Switches
26 5100	Interior Lighting
26 5600	Exterior Lighting
26 5701	Occupancy Sensors
27 4000	Sound Systems
28 3100	Digital, Addressable Fire Alarm System

Bid Category Notes (Including, but not limited to):

19. Provide all demolition of electrical items as shown or specified. Contractor shall consult with CM for equipment/materials to be turned over to owner. Provide dumpster as required for demo items.
20. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.
21. **This Bid Category is also responsible for Electrical Requirements as shown on the Architectural, Civil and Mechanical Drawings. Review all drawings prior to bidding.**
22. Coordinate delivery and storage of material with the Construction Manager **prior** to delivery.
23. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval of the facility.
24. Include all cutting and coring of walls, floors ceilings, etc. as required for the installation of this work.

25. Provide a complete electrical system including, but not limited to; all wiring, panelboards, fixtures, fire alarm systems, lighting controls, sound systems, etc.
26. Provide Network / Communication raceways as shown or specified.
27. Furnish access panels required for all electrical items, which require access in inaccessible areas. Access panels to be installed by others.
28. Cleaning and protection of the equipment, fixtures, etc. installed in this work are the responsibility of this subcontractor until accepted by Owner, including those items of equipment, fixtures, etc. furnished by others to this subcontractor for installation.
29. All inspection reports from local, state and federal inspection agencies will be provided to the Construction Manager.
30. Include all connections of power wiring to devices, including equipment, motors, heaters, automatic door openers and strikes (review Architectural and Mechanical Drawings for items not shown on Electrical Drawings).
31. Duct smoke detectors shall be provided and installed by this Bid Category.
32. Provide and install all motor starters, disconnects, etc. as shown or specified.
33. Provide electrician on site upon start up of mechanical units to verify proper rotation and power.
34. Fire Alarm drawings to be submitted to State of Michigan within 3 weeks of notice to proceed.
35. The Fire Protection, Electrical, and Mechanical contractors will be required to coordinate with each other to accomplish final layout. Any relocation required to coordinate work will be done at no additional cost to the owner.
36. Remove and re-install power to mechanical equipment on roof as necessary for new roof installation. Work with roofers to provide a MIOSHA approved cover over openings as required. Roofer to temporarily seal opening as required.

BID CATEGORY #29

ROLLER SHADES
Projects 1 and 2

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

12 2116	Vertical Louver Blinds
12 2416	Roller Window Shades

Bid Category Notes (Including, but not limited to):

1. Furnish and install all roller shades.
2. Furnish and install all vertical louver blinds.
3. Field measure all openings.

BID CATEGORY #30

VISUAL DISPLAY BOARDS
Projects 5

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

10 1100 Visual Display Surfaces

Bid Category Notes (Including, but not limited to):

1. Furnish and install marker boards and tack boards as shown or specified.
2. Provide proper cleanup upon completion
3. Protect existing finishes during installation.

BID CATEGORY #31

CLASSROOM CASEWORK
Projects 2, 5

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

07 9200	Joint Sealants
12 3210	Institutional Cabinet Casework

Bid Category Notes (Including, but not limited to):

1. Unload, store and protect unit installation
2. Review all drawings and specifications carefully to verify which casework is provided by this bid category.
3. Contractor is to protect doors, frames, windows, walls, etc. from damage during delivery and installation.
4. Remove all adhesives, markings, etc. upon completion
5. Provide and install joint sealants for all casework installation
6. Perform cleanup and removal of debris upon completion
7. Shop drawings to be provide to Construction Manager within 2-weeks of notice to proceed.

SECTION 00 3100

INFORMATION AVAILABLE TO BIDDERS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SOIL EVALUATION

1.2.1 A copy of the Soil Evaluation Report is included in the Specification.

Title:	Geotechnical Engineering Report Clawson Public Schools Clawson High School Soccer Field Clawson Middle School Tennis Courts
Date:	December 5, 2014
Prepared By:	Soils and Materials Engineers, Inc

1.2.2 This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of the designers.

1.2.3 The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

1.2.4 This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting additions or deductions to the Contract Sum accruing to the Owner.

END OF SECTION 00 3100

SECTION 00 3113

MILESTONE SCHEDULE

All bid categories shall participate in coordinating the construction schedule with both the Construction Manager and other trade contractors to meet the Milestone Dates indicated in the bidding documents. The dates either listed below or on the attached schedule are not intended to be a complete breakdown of the work; rather it is a list of milestone dates that must be met by all trade contractors to ensure the project is completed on time. Trade contractors shall include all costs they feel are necessary to complete the work by these milestone dates and include all overtime and shift work even if not called for in the scope description. All trade contractors shall endeavor to improve upon the milestone dates if possible.

If a bidder feels that the dates given are unreasonable or they are impossible to meet, they are to notify R.C. Hendrick by email prior to the bid date. R.C. Hendrick will review the request and, if necessary, issue an addendum modifying the Milestone Schedule. If no objections are heard, it will be understood that the Milestone Schedule can be met by all trade contractors.

Meeting the schedule is an imperative part of the project to all parties, therefore R.C. Hendrick reserves the right to take or recommend the following action(s) if the milestone dates are in danger of, or not, being met.

1. R.C. Hendrick will request a written recovery schedule from the trade contractor(s).
2. The trade contractor(s) will be directed to increase crew size or add equipment on site.
3. The trade contractor(s) will be directed to add a second shift or work overtime.
4. If the above measures do not fulfill the requirements of the Milestone Schedule, the trade contractor(s) may be supplemented with additional personnel or equipment by others, or any necessary action required.

All costs associated with the above measures will be the responsibility of the trade contractor(s) involved, to the extent that it was delayed by others. If a trade contractor is found to have delayed the work, they will be responsible for any additional costs necessary to get the project back on schedule.

END OF SECTION 00 3113

SECTION 00 3146

PERMITS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PERMITS AND FEES

1.2.1 The Owner, through the Construction Manager shall pay for and furnish the general Building Permit.

1.2.2 Other than the Building Permit, each Trade Contractor is required to secure and pay for all permits and fees necessary for your scope of work.

1.2.3 The Construction Manager shall schedule the General Building Inspection. Trade Contractors will be notified verbally or in writing of the date of inspection(s).

1.2.4 It is the responsibility of each Trade Contractor to schedule appropriate inspections of the work by the authorized inspector of the permit you secured. The Construction Manager is to be notified immediately of any scheduled inspection(s).

1.2.5 This project is under the following jurisdictions:

Building	Oakland County
Life Safety	Bureau of Fire Services
Mechanical	Oakland County
Electrical	Oakland County
Soil Erosion	Oakland County-Obtained by Owner
Right of Way	Oakland County
Demolition	Oakland County

END OF SECTION 00 3146

SECTION 00 4000

BID FORM

TO: Monique Beels - Superintendent
Clawson Public Schools
626 Phillips Avenue
Clawson, MI 48017

RE: Clawson Public Schools

Having carefully reviewed the bidding documents described in Section 001000 and understanding the scope of work involved in the proposed Bid Category and those that interface with it, we hereby propose to furnish labor, materials, tools, equipment, supervision, insurance and services required for the completion of all work required for the Bid Category indicated in accordance with the Bid Category Description and the Contract Documents prepared by the Architect and Construction Manager

BID CATEGORY #: _____ **DESCRIPTION:** _____

BIDDERS NAME: _____

BASE BID:

Total Base Sum of _____

_____ Dollars $ _____

(OPTIONAL) COMBINED BID FOR CATEGORIES _____:

Total Combined Sum of _____

_____ Dollars $ _____

ADDENDA:

And Having Received and Examined the Following Addenda: (include date for acknowledgement)

Addendum Number _____, dated _____, 2014
Addendum Number _____, dated _____, 2014
Addendum Number _____, dated _____, 2014
Addendum Number _____, dated _____, 2014

BIDDERS NAME: _____

ALTERNATES:

Bidders shall indicate on the Bid Form if the Alternate is an ADD or DEDUCT to the Base Bid and indicate the costs associated. If the Alternate does not affect your base bid you must circle NO CHANGE. See Specification Section 01 2300 and the drawings for the full descriptions.

Alternate No. M-1S (Schalm Elementary School)
Provide unit price to remove and replace portion (approximately 39 lf) of existing gym supply air ductwork exposed within gym with new ductwork per plans and specifications. Scope shall include: demolition; new galvanized spiral sheet metal ductwork; air distribution devices and test and balance thereof; wall cutting and patching (to extend gym spiral thru wall via sealed penetration and transition within mezzanine); hoisting; labor and supervision.

ADD $ _____ DEDUCT $ _____ NO CHANGE

Alternate No. M-2S (Schalm Elementary School)
Provide separate pricing (refer to electrical plans for additional information) to replace existing RTU-4 (kitchen MAU: 1200 cfm with on/off gas heat with a new Trane MAU having modulation gas heat). Scope shall include: demolition and disconnections, ductwork reconnection, gas piping reconnection, labor, supervision, hoisting, test & balance, expanding mechanical controls (including new Basnet DDC), warranty, start-up, check-out and one new Trane MAU complete with new dampers and controls tied into existing JCI front end. Temperature controls contractor shall, through the existing front end, enable unit; send gas heat signal; and modulate OA and RA dampers (Bacnet is not available by the manufacturer on these units).

ADD $ _____ DEDUCT $ _____ NO CHANGE

Alternate C-1S (Schalm Elementary)
Provide separate pricing to remove existing concrete sidewalk and replace with new 4" thick concrete sidewalk along the north side of the building at the Play area. See Civil drawings for area noted Alternate #1.

ADD $ _____ DEDUCT $ _____ NO CHANGE

Alternate C-2S (Schalm Elementary)
Provide separate pricing to remove existing concrete sidewalk and replace with new 4" thick concrete sidewalk from the northeast corner of the building to the adjacent street to the East. See Civil drawings for area noted Alternate #2.

ADD $ _____ DEDUCT $ _____ NO CHANGE

BIDDERS NAME: _____

Alternate C-3S (Schalm Elementary)
Provide separate pricing to remove existing concrete sidewalk and replace with new 4" thick concrete sidewalk along the East side of the building. See Civil drawings for area noted Alternate #3.

ADD $ _____ DEDUCT $ _____ NO CHANGE

Alternate No. A-1K (Kenwood Elementary School)
Provide fabric covered 8'-0" high moveable wall sections with panels in equal lengths of 8'-0" and 12'-0" for Media center dividers. Spec criteria of panels: Width to range between 24" to 48" wide / Able to be folded or stackable / Have smooth rolling
rubber wheels with step brakes

ADD $ _____ DEDUCT $ _____ NO CHANGE

Alternate No. M-1K (Kenwood Elementary School)
Provide unit price to remove existing floor mounted water closet and furnish and install new water closet WC-1 (replacement of flush valves and exposed piping part of base bid under new work). Locations to be determined.

ADD $ _____ DEDUCT $ _____ NO CHANGE

Alternate No. M-2K (Kenwood Elementary School)
Provide separate pricing (refer to electrical plans for additional information) to replace RTU-7 (kitchen MAU: 1200 cfm with on/off gas hear with a new Trane MAU having modulating gas heat). Scope shall include: demolition and disconnections, ductwork reconnection, gas piping reconnection, labor, supervision, hoisting, test & balance, expanding mechanical controls (including new Bacnet DDC), warranty, start-up, check-out and one new Trane MAU complete with new dampers and controls tied into existing JCI front end. Temperature controls contractor shall, through the existing front end, enable unit; send gas heat signal; and modulate OA and RA dampers (Bacnet is not available by the manufacturer on these units).

ADD $ _____ DEDUCT $ _____ NO CHANGE

Alternate No. A-1M (Clawson Middle School)
Provide new porcelain tile flooring and base (see finish schedule) in existing boys and girls toilet rooms A125, B116, A222 and B213 (Cost to include removal of existing and patching of subbase for installation of new tile)

ADD $ _____ DEDUCT $ _____ NO CHANGE

BIDDERS NAME: _____

Alternate No. A-2M (Clawson Middle School)
Provide new solid plastic toilet partitions (see specifications) in existing locations for existing toilet rooms A125, B116, A22 and B213. Cost to include removal and reinstallation of toilet room accessories on new partitions).

ADD $_____ DEDUCT $_____ NO CHANGE

Alternate No. A-1H (Clawson High School)
Provide cost to remove existing 18 classroom chalkboards (2 per room) and replace with two new 8'-0" x 4'-0" markerboards. Price to include removing all glue residue and painting existing teaching wall.

ADD $_____ DEDUCT $_____ NO CHANGE

Alternate No. A-1B (Baker Administration)
Provide cost to remove existing first floor closet doors and soffit and install new tall storage with laminate soffit closure panels – see plans for model information and locations.

ADD $_____ DEDUCT $_____ NO CHANGE

Alternate C-1B (Baker Administration)
Provide cost to remove and replace the remainder of the Heavy-duty asphalt pavement within the main drive. See Civil drawings for area noted Alternate #1.

ADD $_____ DEDUCT $_____ NO CHANGE

UNIT PRICES:
Unit prices shall include all necessary material plus costs for delivery, installation, insurance, bonds, applicable taxes, overhead and profit. See the drawings and Section 01 2200.

UP #01
Replace 1000 sq ft classroom acoustical ceiling tile and grid system with new 2'x2' AT1 tiles and grid. Unit of Measurement per square foot.

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

BIDDERS NAME: _____

UP #02

Replace 3’-0” x 7’-0” existing hollow metal classroom entry door with new solid wood door (see specifications) in existing frame (price to include removal of old door and painting of existing hollow metal frame). Unit of Measurement: Per Item.

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

UP #03

Replace 3’-0” x 7’-0” existing pool door and frame with new FRP door and aluminum frame (see specifications) in existing location (price to include removal of old door and frame). Unit of Measurement: Per Item.

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

UP #04

Replace 3’-0” x 7’-0” FRP existing exterior door and replace with new FRP door (see specifications) in existing location (price to include removal of old door and painting of existing frames). Unit of Measurement: Per Item.

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

UP #05

Replace existing concrete walks with new 4” concrete sidewalk – sawcut and remove existing concrete sidewalk, full depth, remove existing base material as necessary to provide cross section thickness, prepare and compact final base layer, and pour new 4” concrete sidewalk. Place expansion joints where new concrete abuts existing concrete, building, or structure to remain. Cost shall include all required forms, expansion joint filler and sealant and curing compound. Unit of measure per square foot.

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

BIDDERS NAME: _____

UP #06

Replace existing concrete walks with new 6" concrete sidewalk – sawcut and remove existing concrete sidewalk, full depth, remove existing base material as necessary to provide cross section thickness, prepare and compact final base layer, and pour new 6" concrete sidewalk. Place expansion joints where new concrete abuts existing concrete, building, or structure to remain. Cost shall include all required forms, expansion joint filler and sealant, and curing compound. Unit of measure per square foot.

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

UP #07

Provide cost for sidewalk expansion joint replacement which shall include sawcutting the existing concrete sidewalk joint as necessary, removal and disposal of any existing material with the joint, and placing new expansion joint filler material and sealant per current MDOT specifications. Unit of measure per linear foot.

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

Unit Price #08

Provide unit cost for linear length of vertical blinds per specifications. Unit of measurement per linear foot

1) Material Quantity:_____
2) Number of Staffing: _____persons
3) Labor Hours: _____ hours
4) Overhead/profit: $_____
5) Total Taxes: $_____
6) Total Cost per Unit: $_____

BIDDERS NAME: _____

SUBSTITUTIONS:
Bidder is cautioned to bid on the "Standards" specified. The following substitutions from the "Standards" specified are listed herein for consideration, and if accepted, the contract sum may be adjusted in accordance with the following:

_____ Add / Deduct $ _____

_____ Add / Deduct $ _____

BIDDERS NAME: _____

WORK TIME:
The undersigned hereby agrees to complete the entire work per the Milestone Schedule.

EXPERIENCE MODIFICATION RATE (EMR):
List the EMR for your firm as described by your insurance carrier for the past three (3) years.

2013 _____ 2012 _____ 2011 _____

CONTRACT:
The undersigned agrees that the above Base Bid Prices shall hold for 60 days and Alternate Prices for 120 days after receipt of proposals, to accept provisions of "Instructions to Bidders."

TIME AND MATERIAL RATES: (REQUIRED)
Labor rates listed below include the following: Cost of labor including Michigan Single Business Tax, Social Security and Medicare, Federal and State Unemployment tax, and Fringe Benefits Under Collective Bargaining Agreements, and Worker's Compensation Insurance. The rates listed below do not include overhead and/or profit. These rates are only for additions and/or deletions to the contract that could not have been anticipated at the time of the bid.

Trade	Straight Time	Shift Time	1 ½ Time	Double Time

IRAN BUSINESS RELATIONSHIP AFFIDAVIT:
Pursuant to the Michigan Iran Economic Sanctions Act, 2012 P.A. 517, by submitting a bid, proposal or response, Respondent certifies, under civil penalty for false certification, that it is fully eligible to do so under law and that it is not an "Iran Linked Business," as that term is defined in the Act.

SUBMITTED BY:

Firm Name: _____

Address: _____

Email Address: _____

Signed: _____ Title: _____

Typed Name: _____ Date: _____

Phone: _____ Fax: _____

If Bidder is a Corporation, indicate State of Incorporation: _____

If a Partnership, give full names of all Partners: _____

_____

Please submit (3) copies and retain (1) copy for your records.

END OF SECTION 00 4000

SECTION 00 4100

FAMILIAL DISCLOSURE STATEMENT

All bidders must complete the following familial disclosure form in compliance with MCL 380.1267 (Public Act 232 of 2004) and attach this information to the bid.

By the attached sworn and notarized statement we are disclosing the following familial relationship(s) that exists between the owner or any employee of the bidder and any member of the board, intermediate school board, or board of directors or the superintendent of the school district, intermediate superintendent of the intermediate school district, or chief executive officer of the public school academy. The Owner shall not accept a bid that does not include this sworn and notarized disclosure statement.

Disclose any familial relationship and complete the form below in its entirety:

The following are familial relationships as described above (provide employee name, family contact name, family contact position, and familial relationship or NONE.)

_____

_____

_____

Signature(s): _____ Title: _____

Name of firm: _____

STATE OF MICHIGAN)
) SS
COUNTY OF)

On this _____day of_____ , 20___, before me a Notary Public in and for said county, personally appeared_____, agent of the said firm _____and who acknowledged the same to be his free act and deed as such agent.

_____
Notary Public

END OF SECTION 00 4100

SECTION 00 5000

CONTRACT / AGREEMENT FORM

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTRACT / AGREEMENT FORM

1.2.1 Contracts will be direct between the Owner and the Trade Contractor.

1.2.2 The form of agreement will be the Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, AIA Document A132-2009.

1.2.3 A sample copy of the agreement form can be viewed or downloaded at: www.rchendrick.com. Click on "Plan Room" and then click on the link "Specification Forms."

END OF SECTION 00 5000

SECTION 00 6100

BONDS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 BID BONDS

1.2.1 Each bid which exceeds $50,000 must be submitted with an attached certified check, money order, or a bid bond from a surety company approved to do business in the State of Michigan, payable to the **Owner** in an amount not less than 5% of the base bid sum of the work.

1.3 PERFORMANCE AND PAYMENT BONDS

1.3.1 Prior to the execution of the contract, furnish bonds covering the faithful performance of the contract and the payment of all obligations arising there under. Include cost of bonds in the base bid. The bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of their power of attorney.

END OF SECTION 00 6100

SECTION 00 7200

GENERAL CONDITIONS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 GENERAL CONDITIONS

1.2.1 The General Conditions which shall become a part of the agreement will be the General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, AIA Document A232-2009.

1.2.2 A sample copy of the General Conditions can be viewed or downloaded at: www.rchendrick.com. Click on "Plan Room" and then click on the link "Specification Forms."

END OF SECTION 00 7200

SECTION 00 7300

SUPPLEMENTARY CONDITIONS

GENERAL CONDITIONS

1. The General Conditions of this contract are the American Institute of Architects Standard Document A232-2009, titled "General Conditions of the Contract for Construction, Construction Manager as Adviser Edition." This document is hereby made part of the Contract Documents.

2. The following supplements modify AIA Document A232-2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 2 – OWNER

1. Delete subparagraph 2.2.5 and substitute:
   2.2.5 – The Contractor will be furnished, subject to a deposit, all copies of drawings and specifications reasonably necessary for execution of the work as determined by the Construction Manager.

ARTICLE 3 – CONTRACTOR

1. Add Section 3.4.2.1 to Section 3.4.2:
   3.4.2.1 After the Contract has been executed, the Owner, Construction Manager and Architect will consider requests for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications).
   By making requests for substitutions, the Contractor:
   - **.1** represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
   - **.2** represents that it will provide the same warranty for the substitution as it would have provided for the product specified;
   - **.3** certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent; and
   - **.4** shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

2. Delete subparagraph 3.4.3 and substitute:
   3.4.3 The Contractor shall at all times enforce strict discipline and good order among the Contractor's employees and any subcontractor employed by the contractor and shall not employ on the work any unfit person or anyone not skilled in the task assigned to them.

3. Add subparagraph 3.7.6

3.7.6 Regarding OSHA fines: The Contractor for any fines incurred as a result of the Contractor shall reimburse the Construction Manager for similar fines against the Construction Manager.

4. Add subparagraph 3.9.4
3.9.4 The Construction Manager reserves the right to cause the replacement of the superintendent, assistant superintendent or employee of the contractor who is not qualified, in the opinion of the Construction Manager to do the work.

ARTICLE 5 – SUBCONTRACTORS

1. RE: Subparagraphs 5.2.1, 5.2.2, 5.2.3, and 5.2.4.
Delete the words, "the Construction Manager or Architect" and insert the words, "the Construction Manager and Architect."

ARTICLE 7 – CHANGES IN THE WORK

1. Add Subparagraph 7.1.4
7.1.4 The maximum allowable markup on Changes in the Work shall be eleven percent (11%) which includes overhead, profit, estimating expenses, other office expense, bond and insurance costs."

2. RE: Subparagraph 7.3.7
Delete the words, "the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount." and insert the words, "Section 7.1.4."

ARTICLE 8 – TIME

1. Add subparagraph 8.3.4
8.3.4 Claims for Delay: In the event the contractor is delayed in completing the work by the Owner for any reason, whether intentional or otherwise, and the delay does not preclude the contractor from completing the work within the time period specified in the contract agreement, the contractor shall be entitled to no remedy for such delay.

ARTICLE 9 – PAYMENTS AND COMPLETION

1. Add subparagraph 9.3.1.3
9.3.1.3 Up to time the work is substantially complete, the owner will make monthly payments to the contractor, based on the schedule of values of 90% of the value of labor and materials incorporated in the work and of 90% of all tangible materials stored at the site during that month. The Owner will have retained five percent (5%) of the total contract price for "Closeout Materials" and five (5%) of the total contract price for "Punch List Completion". The Contractor may request payment of the retained percentages upon completion of that portion of their Work.

2. Add subparagraph 9.3.1.4
9.3.1.4 Deliver estimates to the Construction Manager for approval as agreed upon. The form of application for payment shall be AIA Document G732-2009, notarized by Contractor and supported by AIA Document G703 – Continuation Sheet.

3. Add clause .8 to subparagraph 9.5.1
.8 Unsatisfactory clean-up in accordance with subparagraph 3.15.

ARTICLE 11 – INSURANCE AND BONDS

1. Add the following Sections 11.1.2.1 through 11.1.2.4 to Section 11.1.2:

11.1.2.1 The limits for Worker's Compensation and Employers' Liability insurance shall meet statutory limits mandated by State and Federal laws. If (1) limits in excess of those required by statute are to be provided, (2) the employer is not statutorily bound to obtain such insurance coverage, or (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

WORKER'S COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE:

Worker's Compensation:	State of Michigan Statutory Limits
Employer's Liability:	\$500,000 – each accident \$500,000 – disease (each employee) \$500,000 – disease (policy limit)

11.1.2.2 The limits for Commercial General Liability insurance including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse, and Underground Hazards) shall be as follows:

COMMERCIAL GENERAL LIABILITY INSURANCE:

Bodily Injury	\$1,000,000 – each occurrence \$2,000,000 – aggregate
Property Damage	\$1,000,000 – each occurrence \$2,000,000 – aggregate
Fire Damage (any one fire)	\$100,000
Medical Expense (any one person)	\$5,000

Notes:
(1) Products-Completed Operations Insurance shall be maintained for a minimum period of one (1) year after final payment.
(2) The Owner, Architect and Construction Manager shall be listed as additional insured. The Owner shall be the certificate holder.

11.1.2.3 Automobile Liability insurance (owned, non-owned and hired vehicles) for bodily injury and property damage:

AUTOMOBILE LIABILITY INSURANCE:

Bodily Injury	\$1,000,000
Property Damage	\$1,000,000

11.1.2.4 Umbrella or Excess Liability Coverage:

UMBRELLA / EXCESS LIABILITY INSURANCE:

Umbrella/Excess Insurance	\$2,000,000 – each occurrence \$2,000,000 – aggregate

2. Add Subparagraph 11.3.11

11.3.11 The provisions of this paragraph 11.3 shall not operate to relieve the Contractor of responsibility for loss or damage to the Contractor's own or rented property or property of Contractor's employees of whatever kind or nature, including but not limited to: tools, equipment, forms, scaffolding and temporary structures, including their contents. The Owner shall in no event be liable for loss or damage to the aforementioned items or other property of the contractor that is not included in the permanent construction.

3. Delete Subparagraph 11.3.7 Waivers of Subrogation

ARTICLE 13 – MISCELLANEOUS PROVISIONS

1. Delete subparagraph 13.6 – Interest in its entirety.

END OF SECTION 00 7300

Client#: 41727 DECJU

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 7/15/2013

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:
Producer Name Producer Address Producer Address	PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS: PRODUCER CUSTOMER ID #:

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
Insured Name Insured Address Insured Address	INSURER A : Insurance Company Name	
	INSURER B : Insurance Company Name	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD)	POLICY EXP (MM/DD/YY)	LIMITS	
A	GENERAL LIABILITY	Y					EACH OCCURRENCE	$1,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$50,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$5,000
							PERSONAL & ADV INJURY	$1,000,000
							GENERAL AGGREGATE	$2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$2,000,000
	POLICY X PRO-JECT LOC							$
A	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS						BODILY INJURY (Per accident)	$
	SCHEDULED AUTOS						PROPERTY DAMAGE (Per accident)	$
	HIRED AUTOS							$
	NON-OWNED AUTOS							$
A	X UMBRELLA LIAB X OCCUR	Y					EACH OCCURRENCE	$2,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$2,000,000
	DEDUCTIBLE							$
	RETENTION $							$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N						X WC STATU-TORY LIMITS OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)	N/A					E.L. EACH ACCIDENT	$100,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$100,000
							E.L. DISEASE - POLICY LIMIT	$500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Description of Project:

R.C. Hendrick & Son, Inc. is named as an Additional Insured on the General Liability policy. The

(See Attached Descriptions)

CERTIFICATE HOLDER	CANCELLATION
R.C. Hendrick & Son, Inc. 2885 S. Graham Road Saginaw, MI 48609	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE

JAD

DESCRIPTIONS (Continued from Page 1)

Additional Insured includes coverage for ongoing and completed operations. The insurance is primary and noncontributory to any other insurance carried by R.C. Hendrick & Son, Inc.

SECTION 00 7316

INSURANCE REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 INSURANCE REQUIREMENTS

1.2.1 Each contractor shall provide, to the Owner, through the Construction Manager, a certificate of insurance indicating that all required insurance coverage is in effect. This certificate shall be provided before any Work begins.

1.2.2 Limits of required insurance are listed in the Supplementary Conditions, Section 00 7300 – Article 11. Contractors are to provide at least the limits stated in that section.

1.2.3 The Owner, Architect, and Construction Manager shall be listed as "additional insured" on the insurance certificate.

1.2.4 A sample Acord Insurance Certificate with instructions is attached for your use.

1.3 INSURANCE FOR STORED MATERIAL

1.3.1 If a Contractor wishes to be paid for stored material that is not presently on the jobsite, they will be required to furnish photographic evidence of the material as well as an insurance certificate for the material.

1.4 BUILDER'S RISK INSURANCE

1.4.1 Per the General Conditions, the Owner shall secure and pay for Builder's Risk Insurance for the Project.

END OF SECTION 00 7316

SECTION 00 8100

SAFETY REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SAFETY REQUIREMENTS

1.2.1 Each Trade Contractor is responsible to have their own Company Safety Program in place and shall conduct Work operations in accordance with it.

1.2.1.1 Each Trade Contractor shall provide the Construction Manager a copy of their company safety program either electronically or as a hard copy before the commencement of any Work activities.

1.2.2 All Trade Contractors are required to comply with OSHA, MIOSHA as well as any other agency that has jurisdiction over the Project. In addition, each Trade Contractor shall be responsible for payment of all fines and/or claims levied against the Owner, Architect or Construction Manager for deficiencies relating to the Work or Conduct of a Trade Contractor.

1.2.3 Trade Contractors shall also be required to comply with the R.C. Hendrick Company Safety Manual. A copy of the safety manual is available for review at: www.rchendrick.com. Click on "Plan Room" and then click on the link "Specification Forms."

1.2.4 R.C. Hendrick will also create a Site-Specific Safety Manual that is specifically tailored to the Project. Topics in the manual may include Site-Specific Safety Hazards, Emergency Procedures, Nearest Emergency Center, and Important Contact Information. This manual will be completed prior to the start of construction and will be posted at the jobsite and can be made available electronically if requested.

END OF SECTION 00 8100

SECTION 00 9100

PREVAILING WAGE RATES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.1.2 The State of Michigan Prevailing Wage Rates and instructions which are applicable to this Project are attached to this Section.

1.2 OWNER / CONSTRUCTION MANAGER RESPONSIBILITIES

1.2.1 Issue contracts within ninety (90) days from the date of issuance of rates.

1.2.2 Provide rates for classifications needed but not provided on the Prevailing Rate Schedule.

1.2.3 Review and monitor prevailing wages.

1.3 OWNER / CONSTRUCTION MANAGER RESPONSIBILITIES

1.3.1 Post, in a conspicuous place on the construction site, a copy of all prevailing wage and fringe benefit rates prescribed in contract.

1.3.2 Provide accurate certified payroll records to R.C. Hendrick & Son, Inc. for review.

1.3.3 Contractors and Subcontractors are separately Liable for payment of prevailing wage rates to their employees.

1.3.4 Contractors are responsible for advising all subcontractors of the requirement to pay prevailing wage prior to commencement of work.

1.3.5 Contractor is secondarily liable for payment of prevailing rates that are not paid by a subcontractor.

END OF SECTION 00 9100

SECTION 01 1100

SUMMARY

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes the following:

A. Work covered by the Contract Documents.
B. Type of the Contract.
C. Owner-furnished products.
D. Use of premises.
E. Owner's occupancy requirements.
F. Work restrictions.
G. Specification formats and conventions.

1.2.2 Related Sections include the following:

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1.3.1 Project Identification: Clawson Public Schools – District Wide Renovations

1.3.2 Owner: Clawson Public Schools

1.3.3 Architect: French Associates

1.3.4 Construction Manager: R.C. Hendrick & Son, Inc.

1.4 TYPE OF CONTRACT

1.4.1 Project will be constructed under multiple prime contracts direct with the Owner.

1.5 OWNER-FURNISHED PRODUCTS

1.5.1 Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment.

1.6 USE OF PREMISES

1.6.1 General: Each Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

1.6.2 Use of Site: Limit use of premises to areas as directed by Construction Manager. Do not disturb portions of Project site beyond areas in which the Work is indicated.

A. Owner Occupancy: Allow for Owner occupancy of Project site **and use by the public**.
B. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
   1. Schedule deliveries to minimize use of driveways and entrances.
   2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6.3 Use of Existing Building: Maintain existing building in a weather-tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.7 OWNER'S OCCUPANCY REQUIREMENTS

1.7.1 Full Owner Occupancy: Owner will occupy site and e**xisting** building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.

A. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
B. Provide not less than five (5) calendar days' notice to Owner of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

1.8.1 Existing Utility Interruptions: 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:

A. Notify **Owner** not less than ten days in advance of proposed utility interruptions.
B. Do not proceed with utility interruptions without **Owner's** written permission.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

1.9.1 Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

A. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

B. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

1.9.2 Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

A. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

B. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

1. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.10 MISCELLANEOUS PROVISIONS

2. PRODUCTS (Not Used)

3. EXECUTION (Not Used)

END OF SECTION 01 1100

SECTION 01 2100

ALLOWANCES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes administrative and procedural requirements governing allowances.

A. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

1.2.2 Types of allowances include the following:

A. Lump-sum allowances.
B. Contingency allowances.
C. Testing and inspecting allowances.

1.2.3 Related Sections include, but not limited to the following:

A. Division 01 2600 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for changes.
B. Division 01 4000 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
C. Divisions 02 0000 Sections through 33 0000 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

1.3.1 At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

1.3.2 At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

1.3.3 Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

1.4.1 Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4.2 Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.4.3 Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

1.5.1 Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

1.6.1 Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.

1.6.2 Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 CONTINGENCY ALLOWANCES

1.7.1 Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

1.7.2 Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

1.7.3 Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

1.7.4 At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.8 TESTING AND INSPECTING ALLOWANCES

1.8.1 Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

1.8.2 The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

1.8.3 Costs of services not required by the Contract Documents are not included in the allowance.

1.8.4 At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 UNUSED MATERIALS

1.9.1 Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

A. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

3.2.1 Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. **<u>Schalm Elementary School</u>**
Allowance No. 1:
Include $5,500.00 for exterior brick replacement, tuck pointing and caulking.

B. **<u>Kenwood Elementary School</u>**

Allowance No. 1:

Include $5000 allowance for sidewalk expansion joint replacement – which shall include sawcutting the existing concrete sidewalk joint as necessary, removal and disposal of any existing material with the existing joint, and placing new expansion joint filler material and sealant per current MDOT specifications.

C. **<u>Clawson Middle School</u>**

Allowance No. 1:

Include $8000.00 allowance for Band Room Acoustical sound panels – See Architects interior elevation layout.

D. **<u>Clawson High School</u>**

Allowance No. 1:

Include $5,000.00 for miscellaneous roof patching at new mechanical item that will be installed on existing roof – ie.: exhaust fans.

E. **<u>Clawson High School</u>**

Allowance No. 2: Include $5,500.00 for miscellaneous EIFS patching and painting at Gymnasium exterior

END OF SECTION 01 2100

SECTION 01 2200

UNIT PRICES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITION

A. A Unit price is stated on the Bid Form as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 UNIT PRICES

A. Unit prices include all necessary material plus cost for delivery, installation, insurance, applicable taxes, overhead and profit.

B. Refer to individual specification sections for work that requires establishment of Unit Prices. Methods of measurement and payment are specified in those sections.

B. The Owner or Construction Manager reserve the right to reject contractor's measurement of work-in-place that involves the use of established unit prices and to have this work measured, at the Owner's expense, by an independent firm acceptable to contractor.

B. Additional Unit Prices may be required following the submission of bids.

PART 3 EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. UP-01:

1. Provide unit cost to replace 1000 square foot classroom acoustical ceiling tile and grid system with new 2' x 2' AT1 tiles and grid:

2. Unit of Measurement: (per square foot)

a. Contractors – fill in costs
    1. Material quantity:
    2. Number of staffing: _____ persons
    3. Labor Hours: _____ hours.
    4. Overhead/profit: $_____
    5. Total Taxes: $_____
    6. Total Cost per Unit: $_____.

B. Unit Price No. UP-02:

1. Provide unit cost to replace 3’-0” x 7’-0” existing hollow metal classroom entry door with new solid wood door (see specifications) in existing frame (price to include removal of old door and painting of existing hollow metal frame):

2. Unit of Measurement: (per square foot)

    a. Contractors – fill in costs
        1. Material quantity:
        2. Number of staffing: _____ persons
        3. Labor Hours: _____ hours.
        4. Overhead/profit: $_____
        5. Total Taxes: $_____
        6. Total Cost per Unit: $_____

C. Unit Price No. UP-03:

1. Provide unit cost to replace 3’-0” x 7’-0” hollow metal existing pool door and frame with new FRP door and aluminum frame (see specifications) in existing location (price to include removal of old door and frame).

2. Unit of Measurement: (per item)

    i. Contractors – fill in costs
        1. Material quantity:
        2. Number of staffing: _____ persons
        3. Labor Hours: _____ hours.
        4. Overhead/profit: $_____
        5. Total Taxes: $_____
        6. Total Cost per Unit: $_____

D. Unit Price No. UP-04:

1. Provide unit cost to replace 3’-0” x 7’-0” FRP existing exterior door and replace with new FRP door (see specifications) in existing location (price to include removal of old door and painting of existing frames).

2. Unit of Measurement: (per item)

i. Contractors – fill in costs
    1. Material quantity:
    2. Number of staffing: _____ persons
    3. Labor Hours: _____ hours.
    4. Overhead/profit: $_____
    5. Total Taxes: $_____
    6. Total Cost per Unit: $_____

E. Unit Price No. UP-05:

1. Provide unit cost to replace existing concrete walks with new 4" concrete sidewalk –sawcut and remove existing concrete sidewalk, full depth, remove existing base material as necessary to provide cross-section thickness, prepare and compact final base layer, and pour new 4" concrete sidewalk. Place expansion joints where new concrete abuts existing concrete, building, or structure to remain. Cost shall include all required forms, expansion joint filler and sealant, and curing compound.

2. Unit of Measurement: (per square foot)

    i. Contractors – fill in costs
        1. Material quantity:
        2. Number of staffing: _____ persons
        3. Labor Hours: _____ hours.
        4. Overhead/profit: $_____
        5. Total Taxes: $_____
        6. Total Cost per Unit: $_____

F. Unit Price No. UP-06:

1. Provide unit cost to replace existing concrete walks with new 6" concrete sidewalk –sawcut and remove existing concrete sidewalk, full depth, remove existing base material as necessary to provide cross-section thickness, prepare and compact final base layer, and pour new 6" concrete sidewalk. Place expansion joints where new concrete abuts existing concrete, building, or structure to remain. Cost shall include all required forms, expansion joint filler and sealant, and curing compound.

2. Unit of Measurement: (per square foot)

    i. Contractors – fill in costs
        1. Material quantity:
        2. Number of staffing: _____ persons
        3. Labor Hours: _____ hours.
        4. Overhead/profit: $_____
        5. Total Taxes: $_____
        6. Total Cost per Unit: $_____

G. Unit Price No. UP-07:

1. Provide cost for sidewalk expansion joint replacement which shall include sawcutting the existing concrete sidewalk joint as necessary, removal and disposal of any existing material with the joint, and placing new expansion joint filler material and sealant per current MDOT specifications.

2. Unit of Measurement: (per linear foot)

    i. Contractors – fill in costs
        1. Material quantity:
        2. Number of staffing: _____ persons
        3. Labor Hours: _____ hours.
        4. Overhead/profit: $_____
        5. Total Taxes: $_____
        6. Total Cost per Unit: $_____

H. Unit Price No. UP-08:

1. Provide unit cost for linear length of vertical blinds per specifications.

2. Unit of Measurement: (per linear foot)

    i. Contractors – fill in costs
        1. Material quantity:
        2. Number of staffing: _____ persons
        3. Labor Hours: _____ hours.
        4. Overhead/profit: $_____
        5. Total Taxes: $_____
        6. Total Cost per Unit: $_____

END OF SECTION 01 2200

SECTION 01 23 00

ALTERNATES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes administrative and procedural requirements for alternates as proposed by the Architect.

A. **Voluntary Alternates or Substitutions proposed by Bidders will not form the Base Bid Proposal Price.**

1.3 DEFINITIONS

1.3.1 Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

A. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3.2 Voluntary Alternates: Bidders proposed voluntary alternates and substitutions will not be recognized as part of the Base Bid Price opening. Owner may review voluntary proposals with the successful Bidder.

1.4 PROCEDURES

1.4.1 Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

A. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

1.4.2 Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

1.4.3 Execute accepted alternates under the same conditions as other work of the Contract.

1.4.4 Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

3. EXECUTION

3.1 Schedule of Alternates

Schalm Elementary School

A. Alternate M-1S
Provide unit price to remove and replace portion (approximately 39 lf) of existing gym supply air ductwork exposed within gym with new ductwork per plans and specifications. Scope shall include: demolition; new galvanized spiral sheet metal ductwork; air distribution devices and test and balance thereof; wall cutting and patching (to extend gym spiral thru wall via sealed penetration and transition within mezzanine); hoisting; labor and supervision.

B. Alternate M-2S
Provide separate pricing (refer to electrical plans for additional information) to replace existing RTU-4 (kitchen MAU: 1200 cfm with on/off gas heat with a new Trane MAU having modulation gas heat). Scope shall include: demolition and disconnections, ductwork reconnection, gas piping reconnection, labor, supervision, hoisting, test & balance, expanding mechanical controls (including new Basnet DDC), warranty, start-up, check-out and one new Trane MAU complete with new dampers and controls tied into existing JCI front end. Temperature controls contractor shall, through the existing front end, enable unit; send gas heat signal; and modulate OA and RA dampers (Bacnet is not available by the manufacturer on these units).

C. Alternate C-1S
Provide separate pricing to remove existing concrete sidewalk and replace with new 4” thick concrete sidewalk along the north side of the building at the Play area. See Civil drawings for area noted Alternate #1.

D. Alternate C-2S
Provide separate pricing to remove existing concrete sidewalk and replace with new 4” thick concrete sidewalk from the northeast corner of the building to the adjacent street to the East. See Civil drawings for area noted Alternate #2.

E. Alternate C-3S

Provide separate pricing to remove existing concrete sidewalk and replace with new 4" thick concrete sidewalk along the East side of the building. See Civil drawings for area noted Alternate #3.

Kenwood Elementary School

A. Alternate A-1K

Provide fabric covered 8'-0" high moveable wall sections with panels in equal lengths of 8'-0" and 12'-0" for Media center dividers. Spec criteria of panels: Width to range between 24" to 48" wide / Able to be folded or stackable / Have smooth rolling rubber wheels with step brakes.

B. Alternate M-1K

Provide unit price to remove existing floor mounted water closet and furnish and install new water closet WC-1 (replacement of flush valves and exposed piping part of base bid under new work). Locations to be determined.

C. Alternate M-2K

Provide separate pricing (refer to electrical plans for additional information) to replace RTU-7 (kitchen MAU: 1200 cfm with on/off gas hear with a new Trane MAU having modulating gas heat). Scope shall include: demolition and disconnections, ductwork reconnection, gas piping reconnection, labor, supervision, hoisting, test & balance, expanding mechanical controls (including new Bacnet DDC), warranty, start-up, check-out and one new Trane MAU complete with new dampers and controls tied into existing JCI front end. Temperature controls contractor shall, through the existing front end, enable unit; send gas heat signal; and modulate OA and RA dampers (Bacnet is not available by the manufacturer on these units).

Clawson Middle School

A. Alternate A-1M

Provide new porcelain tile flooring and base (see finish schedule) in existing boys and girls toilet rooms A125, B116, A222 and B213 (Cost to include removal of existing and patching of subbase for installation of new tile)

B. Alternate A-2M

Provide new solid plastic toilet partitions (see specifications) in existing locations for existing toilet rooms A125, B116, A22 and B213. Cost to include removal and reinstallation of toilet room accessories on new partitions).

Clawson High School

A. Alternate A-1H

Provide cost to remove existing 18 classroom chalkboards (2 per room) and replace with two new 8'-0" x 4'-0" markerboards. Price to include removing all glue residue and painting existing teaching wall.

Baker Administration

A. **Alternate A-1B**
Provide cost to remove existing first floor closet doors and soffit and install new tall storage with laminate soffit closure panels – see plans for model information and locations.

B. **Alternate C-1B**
Provide cost to remove and replace the remainder of the Heavy-duty asphalt pavement within the main drive. See Civil drawings for area noted Alternate #1.

END OF SECTION 01 23 00

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This section specifies administrative and procedural requirements for handling and processing contract modifications.

1.2.2 Related Sections

A. Section 013300 – "Submittal Procedures"
B. Section 010270 – "Application for Payment"

1.3 MINOR CHANGES IN THE WORK

1.3.1 Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Construction Manager on AIA form G10/CMa.

1.4 CHANGE ORDER PROPOSAL REQUESTS

1.4.1 Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Construction Manager, with a detailed description of the proposed change and supplemental or revised drawings and specifications, if necessary.

A. These requests will be identified as "BULLETINS."
B. Bulletins issued by the Architect are for information only. Do not consider them as instructions whether to stop work in progress, or to execute the proposed change.
C. Unless otherwise indicated in the bulletin, submit to the Construction Manager for Architect and Owner review, the cost necessary to execute the proposed changes. In the proposal:
1. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

2. Indicate applicable taxes, delivery charges, equipment rental, and amount of trade discounts.
3. Include a statement indicating the effect of the proposed change on the Contract Time.
4. Indicate Overhead and Profit amounts.

1.4.2 Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the contract, the Contractor may propose changes by submitting a request to the Construction Manager for a change.

A. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
B. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
C. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
D. Comply with requirements in Section 001000 Part 6.2 “Substitutions” if the proposed change in the Work requires the substitution of one product or system for a product or system specified.

1.4.3 Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.5 CONSTRUCTION CHANGE DIRECTIVE

1.5.1 When the Owner and Contractor are not in total agreement on the terms of a Change Order Request, the CM may issue a Construction Change Directive (CCD) on AIA Form G714 instructing the Contractor to proceed with a change in the Work for subsequent inclusion in a Change Order.

A. The CCD will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

1.5.2 Documentation: Maintain detailed records on a time and material basis of work required by the CCD.

A. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

1.6.1 Upon the Owner's approval of a Change Order Proposal Request, the Construction Manager will issue a Change Order for signatures of the Owner, Architect, CM, and Contractor on AIA Form G732, as provided in the conditions of the Contract.

2. PRODUCTS (Not Applicable)

3. EXECUTION (Not Applicable)

END OF SECTION 01 2600

SECTION 01 2900

PAYMENT APPLICATION PROCEDURES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

1.2.1 Work included: Comply with procedures described in this Section when applying for progress payment and final payment under the Contract.

1.2.2 Related Work

A. The Contract Sum and the schedule for payments are described in the form of agreement.
B. Payments upon Substantial Completion and Completion of the Work are described in the General Conditions and in Section 017000 of these Specifications.

1.3 QUALITY ASSURANCE

1.3.1 Prior to start of construction, secure the Construction Manager and Architect/Engineer's approval of the Schedule of Values required to be submitted under Paragraph 9.2 of the General Conditions.

1.3.2 During progress of the Work, modify the Schedule of Values as approved by the Construction Manager and Architect/Engineer to reflect changes in the Contract Sum due to Change Orders or other modifications of the Contract.

1.3.3 Base requests for payment on the approved Schedule of Values.

1.4 SUBMITTALS

1.4.1 Formal submittal unless otherwise directed by the Construction Manager:

A. Make formal submittal of request for payment by filling in the agreed data, by typing, on AIA Document G702cMa, "Application and Certificate for Payment, Construction Manager-Advisor Edition," plus Continuation Sheet(s) G703.
B. Sign and notarize the Application and Certificate for Payment.

C. Submit the original of the Application and Certificate for Payment, plus two identical copies to the Construction Manager. The Application is to be made out to the Owner and mailed/delivered to the Construction Manager.

D. The CM will review the formal submittal, and when approved, will sign the Application and Certificate for Payment, will forward to the Architect for signature, and will distribute one fully executed copy to:

1. Contractor
2. Owner
3. Construction Manager File

E. The Owner will, upon approval of the Architect/Engineer, disburse directly to the Contractor in accordance with Article 9 of the agreement between Owner and Contractor.

2. PRODUCTS (Not Applicable)

3. EXECUTION (Not Applicable)

END OF SECTION 01 2900

SECTION 01 2976

SWORN STATEMENTS AND WAIVERS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes administrative and procedural requirements for sworn statements, partial waivers and full waivers.

1.2.2 Sample Sworn Statement and Waivers can be viewed or downloaded at: www.rchendrick.com. Click on "Plan Room" and then click on the link "Specification Forms."

1.2.3 No payment will be made without the proper Sworn Statements and applicable Full or Partial Waivers.

1.3 SWORN STATEMENT

1.3.1 A signed and notarized Sworn Statement shall be included with each payment application.

1.3.2 Sworn Statement shall include all subcontractors and suppliers. List their work description, total contract amount, amounts paid, amounts owing, any retentions held and balances to complete.

1.4 PARTIAL WAIVER

1.4.1 Partial waivers must be provided beginning with the second application for payment. Partial waivers must be provided for every payment listed on the previous month's Sworn Statement.

1.5 FULL WAIVER

1.5.1 Before a Trade Contractor can receive final payment, they must submit full waivers from all subcontractors and suppliers.

END OF SECTION 01 2976

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

A. Generals project coordination procedures.
B. Administrative and supervisory personnel.
C. Coordination Drawings.
D. General installation provisions.
E. Cleaning and protection.
F. Limitations for use of the site.
G. Coordination program.

1.2.2 Related Section: The following Sections contain requirements that relate to this Section:

A. Division 01 3100 Section “Project Management and Coordination” for progress meetings, coordination and pre-installation conferences.
B. Division 01 6000 Section “Product Requirements” for coordinating materials and equipment for general installation.
C. Division 01 7300 Section “Execution Requirements” for Layout and Measurements, specifies procedures for field engineering services, including establishment of benchmarks and control points.

1.3 COORDINATION

1.3.1 Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend upon each other for proper installation, connection, and operation.

A. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

B. Coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
C. Make adequate provisions to accommodate items schedule for later installation.

1.3.2 Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

A. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

1.3.3 Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

A. Preparation of schedules.
B. Installation and removal of temporary facilities.
C. Delivery and processing of submittals.
D. Progress meetings.
E. Project closeout activities.

1.4 LIMITATIONS ON USE OF THE SITE

1.4.1 General: Limitations on site usage as well as specific requirements that impact site utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements administer allocation of available space equitably among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on the site.

1.5 SUBMITTALS

1.5.1 Coordination Drawings: Prepare coordination drawings for above ceiling work, equipment rooms and other areas where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

A. Show the relationship of components on separate Shop Drawings.
B. Indicate required installation sequence.

1.5.2 Staff Names: Within fifteen (15) calendar days of “Notice to Proceed,” submit a list of the Contractor’s principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities. List their addresses and telephone numbers.

A. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

1.5.3 Other Project names, addresses and information:

A. Lists of sub-contractors and erectors.
B. List of suppliers and manufacturers.

2. PRODUCTS (Not applicable)

3. EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

3.1.1 Inspection of Conditions: Require the Installer of each component to inspect both the substrate and conditions under which Work is to be performed. Proceed when unsatisfactory conditions have been corrected.

3.1.2 Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction.

3.2 COORDINATION PROGRAM

3.2.1 It shall be the responsibility of the Construction Manager/General Contractor to coordinate the equipment room requirements and the above ceiling space requirements of the various subcontractors and to determine that adequate clearance is allowed with respect to their equipment and the building.

3.2.2 The Coordination Program shall consist of a series of meetings with all trades involved and the preparation of installation drawings prepared from base drawings produced by the Sheet Metal Subcontractor. The Mechanical, Electrical and Fire Protection Subcontractors shall use the base drawings for producing their individual installation drawing overlays for coordination with other trades.

3.2.3 The following sequence shall be followed:

A. After the award of contract and prior to construction the Construction Manager/General Contractor will schedule a meeting to introduce the Coordination Program and determine its implication to the progress schedule. Attendees shall include the Construction Manager/General Contractor, Owner's Representative, Architect/Engineer and all subcontractors responsible for work in equipment rooms and in or above the ceilings which includes (but is not limited to) those items below:
1. Recessed lighting fixtures.
2. Plumbing waste, vent and roof drainage.

3. Steam, condensate and all other pitched services.
4. Ductwork and appurtenances.
5. Fire protection (sprinkler system).
6. HVAC piping.
7. Plumbing, supply and service piping.
8. Cable tray.
9. Electrical conduit.
    (a) The above list, in descending order, is the precedence for space priority. Recessed light fixtures and space for their installation have first priority, plumbing waste, vent and roof drainage has second priority, etc.

B. The Construction Manager/General Contractor shall confirm that the following have been provided to the Sheet Metal Subcontractor prior to commencing the base drawings:
1. Approved structural steel drawings.
2. Clearance requirements for plumbing, piping, etc. from the Mechanical Subcontractor.
3. Clearance requirements for recessed lighting, cable trays, etc. from the Electrical Subcontractor.
4. Clearance requirements for piping from the Fire Protection Subcontractor.

C. The Sheet Metal Subcontractor shall prepare and provide the Mechanical, Electrical and Fire Protection Subcontractors with reproducible transparent drawings which shall serve as the base drawings. The base drawings shall show column center lines, interior partition locations, and ceiling heights.

D. The Sheet Metal Subcontractor, with reference and consideration to the structural, mechanical, electrical, fire protection, and plumbing requirements provided and the reflected ceiling plans, shall draw, to scale (minimum ¼" scale), the proposed ductwork installation showing duct sizes, equipment layouts, and dimensions from column lines and distance from finished floors to bottom of ducts and equipment. In congested areas, the Sheet Metal Subcontractor shall, in addition, prepare drawings in Section view.

E. The base drawings with ductwork layouts shall be produced in sequence as mandated by the project schedule. The earliest area indicated in the schedule will receive the first effort, etc.

F. When the base drawings for the earliest scheduled area have been completed (time limitation as determined in the initial coordination meeting), the Sheet Metal Subcontractor shall provide the Construction Manager/General Contractor with one set of mylars for each participant in the effort. Upon receipt of the base drawings from the Construction Manager/General Contractor each participant shall incorporate on the drawings, their proposed installation. Each of the subcontractors proposed installation drawings shall indicate to scale, size, equipment layout, equipment clearance requirements, dimensions from column centerlines and distance from the finish floor to bottom of equipment,

piping, conduits, etc. The Contract Drawings shall be followed as a general guide for the proposed installation drawings.

G. The major components to be indicated include (but are not limited to):
   1. Roof drain leaders.
   2. Waste and vent piping.
   3. Fire protection piping.
   4. Plumbing and lab service piping.
   5. HVAC and Mechanical ductwork routing.
   6. Electrical conduit and Cable tray runs.
   7. Contract ceiling heights and Soffit locations.
   8. Access points for access to valves and Dampers.
   9. Firewall penetrations.

H. Prior to fabrication of ductwork and within a period of not to exceed two (2) calendar weeks after distribution of the mylars to the individual participants, the Construction Manager/General Contractor will schedule a meeting with the Owner's Representative, the Architect/Engineers and participating Subcontractors at which time areas of conflict shall be resolved through the following process:
   1. The transparent tracings shall be overlaid on a light table to identify areas of conflict. All parties shall then cooperate in resolving the conflicts.
   2. The Owner's Representative and the Architect/Engineer reserve the right to determine space priority of the Subcontractors in the event of interference between piping, conduits, ducts and equipment of the various Subcontractors.
   3. Records of the areas of conflict and the names of the subcontractor who is to make modifications to their drawings shall be kept by the Construction Manager/General Contractor. This record shall be updated on a weekly basis and shall be incorporated into the coordination meeting minutes.
   4. Once all areas of conflict are resolved, each participant shall revise their drawings and shall submit for review. After review, ductwork can be fabricated, and installation of work can begin. A permanent record of the agreement shall be entered on each Subcontractors' installation drawings, acknowledged by all participants' by signature in a space provided for this purpose. The Construction Manager/General Contractor shall provide and distribute two graphic copies of each subcontractor's signed installation drawings to all parties involved. Revisions to drawings as a result of the coordination process shall not be considered an extra and will not result in a change to the contract.
   5. The above drawings, review and coordination process will be repeated until all areas on the Project have been coordinated.

I. Shop drawings shall be modified through the coordination process to reflect the final resolved locations of equipment prior to submittal for review.

J. In the event a Subcontractor fails to cooperate in the Coordination Program, he shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Subcontractor's installations.

K. When a Change Order request is issued, the affected Subcontractors shall review the Coordination Drawings and bring to the attention of the Construction Manager/General Contractor any revisions necessary to the work of others affected by the Change Order.

3.2.4 At the completion of the project, each subcontractor shall provide the Construction Manager/General Contractor with a reproducible transparent drawing of the installation drawings to be forwarded to the Owner.

3.3 CLEANING AND PROTECTION

3.3.1 Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

3.3.2 Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

3.3.3 Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

A. Excessive static or dynamic loading.
B. Excessive internal or external pressures.
C. Excessively high or low temperatures.
D. Thermal shock.
E. Excessively high or low humidity.
F. Air contamination or pollution.
G. Water or ice.
H. Solvents.
I. Chemicals.
J. Radiation.
K. Puncture.
L. Abrasion.
M. Heavy traffic.
N. Soiling, staining and corrosion.
O. Bacteria.
P. Rodent and insect infestation.
Q. Electrical current.
R. Improper lubrication.
S. Unusual wear or other misuse.
T. Contact between incompatible materials.

U. Misalignment.
V. Excessive weathering.
W. Unprotected storage.
X. Improper shipping or handling.
Y. Theft.
Z. Vandalism.

END OF SECTION 01 3100

SECTION 01 3119

PROJECT MEETINGS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section specifies administrative and procedural requirements for project meeting, including but not limited to: Pre-Construction Meeting, Pre-Installation Meeting, Coordination Meetings and Progress Meetings

1.3 PRE-CONSTRUCTION MEETING

1.3.1 A pre-construction meeting will be held at the Project site or other convenient location by the Construction Manager after execution of the Agreement and prior to commencement of the construction activities. The purpose of the meeting shall be to review responsibilities, personnel assignments and schedule.

1.3.2 Attendees shall include the Owner, Construction Manager, Architect and their consultants, all Contractors and/or their superintendents, major subcontractors, manufacturers, suppliers, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

1.3.3 The meeting may include such topics as: Construction Schedule, Critical Work Sequencing, Designation of Responsible Personnel, Procedures for Processing Field Decisions and Change Orders, Procedures for Processing Applications for Payment, Distribution of Contract Documents, Submittal of Shop Drawings, Product Data and Samples, Preparation of Record Documents, Use of the Premises, Office, Work and Storage Areas, Equipment Deliveries and Priorities, Safety Procedures, First Aid, Security, Housekeeping and Working Hours.

1.4 PRE-INSTALLATION MEETING

1.4.1 The Construction Manager may conduct a pre-installation meeting at the site before each construction activity that requires coordination with other construction. If a Pre-Installation Meeting is scheduled, the installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting.

1.4.2 The purpose of the meeting will be to review the progress of other construction activities in preparation for the particular activity under consideration at each pre-installation conference, including requirements for: Contract Documents, Options, Related Change Orders, Purchases, Deliveries, Shop Drawings, Product Data and Quality Control Samples, Possible Conflicts, Compatibility Problems, Time Schedule, Weather Limitations, Manufacturer's Recommendations, Compatibility of Materials, Acceptability of Substrates, Temporary Facilities, Space and Access Limitations, Governing Regulations, Safety, Inspection and Testing Requirements, Required Performance Results, Recording Requirements, Protection

1.4.3 The Construction Manager shall record significant discussions and agreements and disagreements of each conference, along with the approved schedule. The Construction Manager shall distribute the record of the meeting to everyone concerned promptly, including the Owner and Architect. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

1.5.1 The Construction Manager will conduct progress meetings at regularly scheduled intervals.

1.5.2 In addition to representatives of the Owner, CM, and Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress. Progress Meetings are MANDATORY for those contractors working on site.

A. The Construction Manager reserves the right to delay payment to contractors who fail to attend weekly meetings while on-site.

1.5.3 The agenda shall include reviewing minutes of the previous progress meeting, review other items of significance that could affect progress. Other topics may include: Interface Requirements, Time, Sequences, Deliveries, Off-Site Fabrications Problems, Access, Site Utilization, Temporary Facilities and Services, Hours of Work, Hazards and Risks, Housekeeping, Quality and Work Standards, Change Orders and Documentation of Information for Payment Requests.

1.5.4 The meeting will also include a review of the Construction Schedule. Review progress since the last meeting. Determine where each activity is in relation to the Construction Manager's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to

ensure that current and subsequent activities will be completed within the Contract Time.

1.5.5 Construction Manager will distribute copies electronically of minutes of the meeting to each party present and to other parties who should have been present. The Construction Manager shall also revise the Construction Schedule after each progress meeting where revisions to the Schedule have been made or recognized and will issue the revised Schedule concurrently with the report of each meeting.

2. PRODUCTS (Not Used)

3. EXECUTION (Not Used)

END OF SECTION 01 3119

SECTION 01 3300

SUBMITTAL PROCEDURES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

A. Shop drawings and Samples
B. Product data submittal procedures.
C. Shop Drawing and Samples Transmittal Form.
D. Contract Close-out Deliverables Form.

1.2.1 Related Sections include the following:

A. Division 01 2900 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
B. Division 01 4000 Section "Quality Requirements" for submitting test and inspection reports.
C. Division 01 7700 Section "Closeout Procedures" for submitting warranties.
D. Division 01 7700 Section "Closeout Procedures" for submitting Record Drawings, Record Specifications, and Record Product Data.
E. Division 01 7700 Section "Closeout Procedures" for submitting operation and maintenance manual.
F. Division 01 7700 Section “Closeout Procedures” for submitting videotapes of demonstration of equipment and training of Owner’s personnel.
G. Divisions 02 0000 through 33 0000 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

1.3.1 Action Submittals (Shop Drawings, Samples, Product Data, Catalog Cuts, etc.): Written and graphic information that requires Architect's and Construction Manager's responsive action.

1.3.2 Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

1.4.1 General: All submittals shall be transmitted to the Architect, through the Construction Manager, in electronic (PDF) format using Submittal Exchange. Submittal Exchange is a website service designed specifically for transmitting submittals between construction team members.

A. The Submittal Exchange system will be set up, monitored and administered by the Construction Manager. All subcontractors with an Owner/Contractor Agreement will be required to utilize and comply with the system.

B. All contractors will be required to have internet access at your main office and shall provide an email address that will be used for all correspondence with Submittal Exchange. Contractors shall also utilize Adobe Acrobat, Bluebeam PDF Revu or similar PDF software in order to markup documents and/or apply stamps.

1.4.2 Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

B. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

1. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

1.4.3 Submittals Schedule: Submittal Exchange will create a schedule of submittals for each specification section. Contractors will be required to upload electronic submittals directly to the site and should immediately notify the Construction Manager if an item is missing from the schedule.

1.4.4 Structural steel shop drawings: Prior to the submittal of shop drawings, Pre-submittal Drawings shall be submitted – refer to spec section 05 1200 Structural Steel Framing. The architect and structural engineer will review the Pre-submittal Drawings to clarify the design intent of the Construction Documents and provide additional information as required.

1.4.5 Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

A. Initial Review: Allow twenty (20) calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
B. Resubmittal Review: Allow fifteen (15) calendar days for review of each resubmittal.
C. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow twenty (20) calendar days for initial review of each submittal.
D. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow fifteen (15) calendar days for review of each submittal. Submittal will be returned to Construction Manager, through the Architect, before being returned to Contractor.

1.4.6 Submission of Samples: Physical samples shall be mailed or delivered to the Construction Manager. A transmittal form shall also be submitted on the Submittal Exchange system for markup, approval and records. A minimum of (3) three physical samples are required and all copies may be kept by the Owner, Architect and Construction Manager.

1.4.7. Identification: All submittals shall be accompanied by a transmittal which is attached to the end of this specification section. This transmittal must be filled out completely and it is to be either attached to your electronic submittal or as a separate document in the case of samples submission.

1.4.8 Deviations: Highlight and encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

1.4.9 Additional Physical Copies: The Owner, Architect, or Construction Manager may require a physical copy of the electronic submittal and that will be provided at the submitting contractor's expense.

1.4.11 Resubmittals: Resubmittals should be submitted through the Submittal Exchange system. Resubmit submittals until they are approved by the Architect.

1.4.12 Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

1.4.13 Use for Construction: Use only final submittals with the Architect's approved or reviewed stamp. DO NOT USE Shop Drawings that are noted to be revised or resubmitted for construction or fabrication.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

1.5.1 General: At Contractor's written request, copies of Architect's CAD files may be provided to Contractor for Contractor's use in connection with Project. The Architect may require a payment or fee for use of CAD Drawings.

PART 2 PRODUCTS

2.1 ACTION SUBMITTALS

2.1.1 General: Prepare and submit Action Submittals required by individual Specification Sections.

A. All Action Submitals should be electronically uploaded to Submittal Exchange.
B. Submit physical Samples direct to the Construction Manager. Include a transmittal on Submittal Exchange.

2.1.2 Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

A. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
B. Mark each copy of each submittal to show which products and options are applicable.
C. Include the following information, as applicable:
    1. Manufacturer's written recommendations.
    2. Manufacturer's product specifications.
    3. Manufacturer's installation instructions.
    4. Standard color charts.
    5. Manufacturer's catalog cuts.
    6. Wiring diagrams showing factory-installed wiring.
    7. Printed performance curves.
    8. Operational range diagrams.
    9. Mill reports.
    10. Standard product operating and maintenance manuals.
    11. Compliance with specified referenced standards.
    12. Testing by recognized testing agency.
    13. Application of testing agency labels and seals.
    14. Notation of coordination requirements.
D. Submit Product Data concurrent with Samples.

E. Number of Copies: Submit copies as indicated in Part 1.4 “Submittal Procedures”.

2.1.3 Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

A. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   1. Dimensions.
   2. Identification of products.
   3. Fabrication and installation drawings.
   4. Roughing-in and setting diagrams.
   5. Wiring diagrams showing field-installed wiring, power, signal, and control wiring.
   6. Shop work manufacturing instructions.
   7. Templates and patterns.
   8. Schedules.
   9. Design calculations.
   10. Compliance with specified standards.
   11. Notation of coordination requirements.
   12. Notation of dimensions established by field measurement.
   13. Relationship to adjoining construction clearly indicated.
   14. Seal and signature of professional engineer if specified.
   15. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

B. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.

2.1.4 Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

A. Transmit samples that contain multiple, related components such as accessories together in one submittal package.
B. Identification: Attach label on unexposed side of Samples that includes the following:
   1. Generic description of Sample.
   2. Product name and name of manufacturer.
   3. Sample source.
   4. Number and title of appropriate Specification Section.
C. Disposition: Maintain sets of approved Samples at Project site, available for quality control comparisons throughout the course of construction

activity. Sample sets may be used to determine final acceptance of construction associated with each set.

1. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
2. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

D. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

1. Number of Samples: Submit one (1) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

E. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

1. Number of Samples: Submit number of samples as indicated in Part 1.4 "Submittal Procedures".
    a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    b. If variation in color, pattern, texture, or other haracteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

2.1.5 Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

A. Type of product. Include unique identifier for each product.
B. Room name, room number, space and location.

2.1.6 Application for Payment: Comply with requirements specified in Division 01 Section "Payment Application Procedures."

2.1.7 Schedule of Values: Comply with requirements specified in Division 01 Section “Payment Application Procedures.”

2.1.8 Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

A. Name, address, and telephone number of entity performing subcontract or supplying products.
B. Number and title of related Specification Section(s) covered by subcontract.
C. Drawing number and detail references, as appropriate, covered by subcontract.
D. Number of Copies: Submit two (2) copies of subcontractor list, unless otherwise indicated.

2.2 INFORMATIONAL SUBMITTALS

2.1.1 General: Prepare and submit Informational Submittals required by other Specification Sections. If required, these submittals should be electronic and uploaded directly to Submittal Exchange.

A. Number of Copies: Submit two (2) copies of each submittal, unless otherwise indicated. Architect will not return copies.
B. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
C. Test and Inspection Reports: Comply with requirements in Division 01 4000 Section "Quality Requirements."

2.2.2 Coordination Drawings: Comply with requirements specified in Division 01 3100 Section “Project Management and Coordination.”

2.2.3 Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

2.2.4 Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

2.2.5 Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

2.2.6 Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

2.2.7 Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

2.2.8 Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

2.2.9 Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

2.2.10 Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

2.2.11 Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

A. Name of evaluation organization.
B. Date of evaluation.
C. Time period when report is in effect.
D. Product and manufacturers' names.
E. Description of product.
F. Test procedures and results.
G. Limitations of use.

2.2.12 Schedule of Tests and Inspections: Comply with requirements specified in Division 01 4000 Section "Quality Requirements."

2.2.13 Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

2.2.14 Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of

compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

2.2.15 Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

2.2.16 Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 7700 Section "Closeout Procedures" for Operation and Maintenance Data."

2.2.17 Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2.18 Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

A. Preparation of substrates.
B. Required substrate tolerances.
C. Sequence of installation or erection.
D. Required installation tolerances.
E. Required adjustments.
F. Recommendations for cleaning and protection.

2.2.19 Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

A. Name, address, and telephone number of factory-authorized service representative making report.
B. Statement on condition of substrates and their acceptability for installation of product.
C. Statement that products at Project site comply with requirements.
D. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
E. Results of operational and other tests and a statement of whether observed performance complies with requirements.

F. Statement whether conditions, products, and installation will affect warranty.
G. Other required items indicated in individual Specification Sections.

2.2.20 Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles and term of the coverage.

2.2.21 Material Safety Data Sheets (MSDSs): Submit information directly to Construction Manager; do not submit to Architect, except as required in "Action Submittals´Article."

A. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

2.3.1 Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

A. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

2.3.2 Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

A. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

3.1.1 Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with Contractor's review approval stamp before submitting to Architect.

3.1.2 Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

3.2.1 General: Architect will not review submittals that do not bear Construction Manager's or General Contractor's review approval stamp and will return them without action.

3.2.2 Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action to be taken.

3.2.3 Informational Submittals: Architect will review each submittal and will return it to the Construction Manager or General Contractor with review comments for their review.

3.2.4 Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

END OF SECTION 01 3300

SHOP DRAWING AND SAMPLES TRANSMITTAL

FRENCH associates
architects planners interiors

FA Submittal No.

Consultant Submittal No.

Project Name:	Architect's Project No.:	Submittal Date: ☐ Resubmittal	Contr. Submittal No. / Refer. Submittal No.
CM / Contr. Name: / CM / Contr. Address:	Contr. Proj. No.	Sub-Contr, Supplier, Etc. Name: / Sub-Contr, Supplier, Etc. Submittal No:	

Spec Section (not Bid Ctgy.)	No. of Prints	No. of Tracing	No. of Cat/etc.	No. of Sample	Sub-Contractor, Suppler, Manufacturer, Misc.	* List Each * Drawing No.	Drawing Title, Item Description	Architect Review Code	Copies Returned to Contractor

Contractor(s) certifies that the above submitted information has been reviewed in detail and comply with the Contract Documents, except as indicated, and is submitted to the Architect, " FOR REVIEW AND COMMENTS ONLY." The Architect's and Engineer's critique will not relieve the Contractor(s) from compliance with requirements of the Contract Documents. Contractor(s) assumes responsibility for all information and comments indicated in Shop Drawings.

Contractor / Const. Manager Comments

Priority ☐ High ☐ Normal ☐ Low

Signature

Date: Copies: Attn:

CONTRACTOR TRANSMITTED TO:
- ☐ Structural
- ☐ Mechanical
- ☐ Electrical
- ☐ Architect
- ☐ Other

Consultant's Comments

Signature

CONSULTANT TRANSMITTED TO:
- ☐ Architect
- ☐ Other Consul.
- ☐ Other

Architect's Comments

Signature

ARCHITECT TRANSMITTED TO:
- ☐ Contr./Mgr.
- ☐ Consultant
- ☐ Other

Architect Review Code Legend

RC = Reviewed for Construction
That part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance

RN = Reviewed as Noted
That part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

XRR = Returned for Corrections
Do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a "Reviewed for Construction" or "Reviewed as Noted" action mark.

Contractor / Const. Manager - Record Copy Sent To:

Date:

SECTION 01 4000

QUALITY REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes administrative and procedural requirements for quality assurance and quality control.

1.2.2 Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

A. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
B. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and -control procedures that facilitate compliance with the Contract Document requirements.
C. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.2.3 Related Sections include the following:

A. Division 01 7329 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
B. Divisions 02 0000 through 33 0000 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

1.3.1 Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

1.3.2 Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

1.3.3 Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

1.3.4 Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

1.3.5 Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

1.3.6 Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

1.3.7 Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

1.3.8 Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3.9 Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1.4 CONFLICTING REQUIREMENTS

1.4.1 General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.4.2 Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may

exceed the minimum limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements.

1.5 SUBMITTALS

1.5.1 Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5.2 Schedule of Tests and Inspections: Prepare in tabular form and include the following:

A. Specification Section number and title.
B. Description of test and inspection.
C. Identification of applicable standards.
D. Identification of test and inspection methods.
E. Number of tests and inspections required.
F. Time schedule or time span for tests and inspections.
G. Entity responsible for performing tests and inspections.

1.5.3 Reports: Prepare and submit certified written reports that include the following:

A. Date of issue.
B. Project title and number.
C. Name, address, and telephone number of testing agency.
D. Dates and locations of samples and tests or inspections.
E. Names of individuals making tests and inspections.
F. Description of the Work and test and inspection method.
G. Identification of product and Specification Section.
H. Test and inspection results and an interpretation of test results.
I. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
J. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
K. Name and signature of laboratory inspector.
L. Recommendations on retesting and reinspecting.

1.5.4 Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

1.6.1 General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

1.6.2 Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

1.6.3 Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.6.4 Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.6.5 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

1.6.6 Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

A. Requirement for specialists shall not supersede building codes and regulations governing the Work.

1.6.7 Testing Agency Qualifications: An NRTL, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

A. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

1.6.8 Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.6.9 Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

A. Contractor responsibilities include the following:
   1. Provide test specimens representative of proposed products and construction.
   2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   4. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   5. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   6. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

B. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.6.10 Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

A. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
B. Notify Architect and Construction Manager seven (7) calendar days in advance of dates and times when mockups will be constructed.
C. Demonstrate the proposed range of aesthetic effects and workmanship.
D. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
   1. Allow seven (7) calendar days for initial review and each re-review of each mockup.
E. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
F. Demolish and remove mockups when directed, unless otherwise indicated.

1.6.11 Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through Divisions 33.

1.7 QUALITY CONTROL

1.7.1 Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

A. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
B. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
C. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, **and the Contract Sum will be adjusted by Change Order**.

1.7.2 Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

A. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
B. Notify testing agencies at least forty-eight (48) hours in advance of time when Work that requires testing or inspecting will be performed.
C. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
D. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
E. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

1.7.3 Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 3300 Section "Submittal Procedures."

1.7.4 Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

1.7.5 Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractors in performance of duties. Provide qualified personnel to perform required tests and inspections.

A. Notify Architect, Construction Manager, and Contractors promptly of irregularities or deficiencies observed in the Work during performance of its services.
B. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
C. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
D. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
E. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
F. Do not perform any duties of Contractor.

1.7.6 Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel.

A. Incidental labor and facilities necessary to facilitate tests and inspections.
B. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
C. Facilities for storage and field curing of test samples.
D. Delivery of samples to testing agencies.
E. Preliminary design mix proposed for use for material mixes that require control by testing agency.
F. Security and protection for samples and for testing and inspecting equipment at Project site.

1.7.7 Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

A. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.7.8 Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within thirty (30) calendar days of date established for **commencement of the Work** or **the Notice to Proceed**.

A. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

1.8.1 Special Tests and Inspections: Owner may engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1.8.2 Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

A. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
B. Notifying Architect, Construction Manager, and Contractors promptly of irregularities and deficiencies observed in the Work during performance of its services.
C. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, Construction Manager, with copy to Contractors and to authorities having jurisdiction.
D. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
E. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
F. Retesting and re-inspecting corrected work.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

3.1.1 Construction Manager and Owner will select testing agency before construction begins.

A. Construction Manager or Contractor may recommend testing agency firm to the Architect or Owner for decision.

3.2 TEST AND INSPECTION LOG

3.2.1 Prepare a record of tests and inspections. Include the following:

A. Date test or inspection was conducted.
B. Description of the Work tested or inspected.
C. Date test or inspection results were transmitted to Architect.
D. Identification of testing agency or special inspector conducting test or inspection.

3.2.2 Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

3.3 REPAIR AND PROTECTION

3.1.1 General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

A. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
B. Comply with the Contract Document requirements for Division 01 7329 Section "Cutting and Patching."

3.1.2 Protect construction exposed by or for quality-control service activities.

3.1.3 Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.

A. Temporary utilities, services and facilities will be provided by the Owner through the CM unless otherwise noted or directed by the CM.

1. Each Contractor shall provide their own hoisting, loading and unloading.
2. Contractors shall arrange for, and schedule, all deliveries during their own normal workday hours.
3. **EACH CONTRACTOR IS RESPONSIBLE FOR THEIR OWN WINTER PROTECTION AS IT RELATES TO YOUR SCOPE OF WORK.**

1.2.2 Temporary Utilities include, but are not limited to:

A. Temporary Water Service
1. By Owner

B. Temporary Electric, Power and Light
1. By Electrical Contractor

1.2.3 Temporary Construction and Support Facilities include, but are not limited to:

A. Temporary Heat – CM will direct contractor to hook up temporary building heat a Time & Materials basis. The Owner will pay for utility usage.

B. Field Offices
1. By Each Trade Contractor

C. Temporary Toilets
1. By Owner

F. Rodent and Pest Control
1. By Owner

G. Dumpster
1. By Owner
a. **Dumpster is for minor debris only.** No Masonry, Concrete, Pallets or other major items are allowed. CM will back charge contractor for misuse of Dumpster.
b. Cleanup is the responsibility of each Bid Category. If necessary, CM will cleanup and back charge contractors accordingly (Refer to Section 017100).

H. Temporary Enclosures

1. Temporary Supports
a. All Bid Categories shall include all costs necessary to enclose, heat, and brace their work as required per MIOSHA to maintain progress. This is required for the duration of the project.

2. Temporary Partitions
a. By Owner

3. Building Enclosures (As Directed By CM)
a. By General Trades Contractor

1.2.4 Security and protection facilities required include, but are not limited to:

A. Temporary Fire Protection
1. By Each Trade Contractor

B. Barricades, Warning Lights, Signs, Etc.
1. By Each Trade Contractor per MIOSHA Regulations

C. Environmental Protection
1. By Each Trade Contractor

1.3 QUALITY ASSURANCE

1.3.1 Regulations: Comply with industry standards and applicable laws and regulation for authorities having jurisdiction including, but not limited to:

A. Building Code Requirements
B. Health and Safety Regulations
C. Utility Company Regulations
D. Environmental Protection Regulations

1.3.2 Standards: Comply with the following codes and standards:

A. NFPA Code 241 – “Building Construction and Demolition Operations”
B. ANSI-A10 Series – “Safety Requirements for Construction and Demolition”
C. NECA Electrical Design Library – “Temporary Electrical Facilities”

1.3.3 Refer to “Guidelines for Bid Conditions for Temporary Job Utilities and Services,” prepared jointly by AGC and ASC for industry recommendations.

1.3.4 Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

1.3.5 Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certification and permits.

1.4 PROJECT CONDITIONS

1.4.1 When acceptable to the Owner, change over from use of temporary service to use of the permanent service.

1.4.2 Conditions of Use

A. Keep temporary services and facilities clean and neat in appearance
B. Operate in a safe and efficient manner
C. Take necessary fire prevention measures
D. Do not overload facilities or permit them to interfere with progress
E. Do not allow hazardous, dangerous, unsanitary conditions or public nuisances to develop or persist on the site.

2. PRODUCTS

2.1 MATERIALS

2.1.1 General – Provide new materials or undamaged previously used materials in serviceable condition.

2.1.2 Lumber and Plywood – For safety barriers, sidewalks, bridges and similar uses, provide minimum $^{5}/_{8}$” thick exterior plywood.

2.1.3 Tarpaulins – Provide waterproof, fire resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures; provide translucent, nylon, reinforced, laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.

2.1.4 Water – Use Potable Water.

2.2 EQUIPMENT

2.2.1 Water Hoses – Shall be ¾" heavy-duty, abrasion resistant, flexible, rubber hoses with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shut-off nozzles at hose discharge.

2.2.2 Electrical Outlets – Properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment (Refer to Section 16000 – Electrical).

2.2.3 Electrical Power Cords – Shall be provided by each Bid Category and shall be ground extension cords. Use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress.

2.2.4 Heating Units – Temporary heating units shall be tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

2.2.5 Temporary Offices – Each Contractor shall provide prefabricated or mobile units with lockable entrances, operable windows, and serviceable finishes. Provide heated units on foundations adequate for normal loading. Construction Manager is not responsible for temporary offices, trailers, or the contents inside such trailers.

2.2.6 Temporary Toilet Unit – Provided by Owner

2.2.7 First Aid Supplies – Each Bid Category Contractor shall comply with governing regulations.

2.2.8 Fire Extinguishers – Shall be portable UL-rated, Class "A" fire extinguishers for temporary offices and similar spaces. In other locations, provide portable, UL-rated, Class "ABC" dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for the exposures.

A. Comply with NFPA 10 *AND* 241 for classification, extinguishing agent and size required by location and class of fire exposure.

3. EXECUTION

3.1 INSTALLATION

3.1.1 Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum

interference with performance of the Work. Relocate and modify facilities as directed by the Construction Manager.

3.1.2 Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

3.2.1 Owner will provide permanent power to main transformer pad. As soon as possible, contractors may have to supply portable generators until temporary power is established or during shutdown if required.

A. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary service (Refer to Section 16000).

B. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services (Refer to Section 16000).

3.2.2 Temporary Electric Power Service – Provide a minimum of four receptacles every 1000 square feet or as necessary to provide sufficient power for contractors work.

3.2.3 Power Distribution System – Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 volts, AC 20 ampere rating and lighting circuits may be non-metallic sheathed cable where overhead and exposed for surveillance.

3.2.4 Temporary Lighting – Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operation and traffic conditions. Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching (Refer to Section 16000).

3.2.5 Temporary Telephone – At each telephone, a list of emergency numbers shall be posted. Contractors may use Construction Manager's for emergency purposes only.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

3.3.1 Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.

A. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion.

Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Each Contractor is responsible for electrical hook-up to their trailers.

C. Any electric heaters or Air Conditioners used for heating or cooling will be metered and paid for by that Contractor.

3.3.2 Provide incombustible construction for offices, shops, and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.

3.3.3 Temporary Heat – Provide temporary heat required by construction activities for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

3.3.4 Heating Facilities – Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.

A. Use of gasoline burning space heaters, open flame or salamander type heating units is prohibited.
B. Any electric heaters used for temporary heating will not be approved unless approved in writing before bid date.

3.3.5 Mechanical and electrical contractors shall expedite their work so that completed or partially completed permanent heating installation may be used as soon as possible. Requirements for temporary use of these systems are as follows:

A. Do not use permanent duct system until filter units are installed. Change or clean filters frequently and install new filters at completion. Filters may be cleaned only if they are type intended for cleaning. Clean filters in accordance with manufacturer's directions.

B. Thoroughly clean permanent convectors or other permanent space heaters used for temporary heating units. Restore units to original finish at completion of the Work.

C. Set permanent space heaters temporarily, if in the judgment of the Construction Manager, use is required to maintain reasonable temperatures and required to properly dry out the building. Automatic devices, permanent or temporary, shall control temperatures in all

areas. Thoroughly clean valves and traps installed with the units and adjust just prior to project completion.

D. The Owner through the CM shall maintain and operate the temporary building heating system and pay for utility usage costs.

E. Costs for fuel, water and electric power required to operate heating system shall be paid by Owner. Other costs shall be paid by the trade contractor, including costs of providing and installing units, placing and replacing filters, reconditioning units and wages of labor required to operate the system. The Electrical Contractor is to hook up the power to the temporary heaters.

3.3.6 Temporary Lifts and Hoists – All Bid Categories are to provide their own facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.3.7 Project and Temporary Signage – The Owner through the Construction Manager will provide all Project and Directional Signage. All Bid Categories must receive approval from the Construction Manager before installing any signage. The CM reserves the right to remove any and all signage from the Project Site.

3.3.8 Temporary Exterior Lighting – Install exterior yard and sign lights so that signs are visible when work is being performed.

3.3.9 Collection and Disposal of Waste – By all Bid Categories as required. Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. ENFORCE REQUIREMENTS STRICTLY. Do not hold materials more than seven days during normal weather or three days when the temperature is expected to rise above 80º Fahrenheit (27º Celsius). Handle hazardous, dangerous or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

3.4.1 Except for use of permanent fire protection, as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as directed by the CM.

3.4.2 Temporary Fire Protection – Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."

A. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher for every 100ft. (per MIOSHA Rules and Regulations).

B. Store combustible materials in containers in fire-safe locations.

C. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, egress exits and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.

D. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

3.4.3 Permanent Fire Protection – At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

3.4.4 Barricades, Warning Signs and Lights – Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

3.4.5 Temporary Gates and Fencing – To be maintained, locked and kept secure on a daily basis by Construction Manager. The Trade Contractors are expected to participate in locking the site especially if they are working after-hours.

3.4.6 Security Enclosure and Lock-up – Installed and maintained by the Construction Manager. Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

3.4.7 Storage – To be maintained in storage trailers unless approved by Construction Manager. Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lock-up. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

3.4.8 Environmental Protection – Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways and subsoil must be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons of firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

3.5.1 Supervision – Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

3.5.2 Maintenance – Each Bid Category is required to maintain the temporary facilities that they installed. Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.

3.5.3 Termination and Removal – Unless the CM requests that it be maintained longer, remove each temporary facility as the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete, or if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

A. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project Identification Signs.

B. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.

C. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period including but not limited to:

1. Replace air filters and clean inside of ductwork and housings.
    a. By Mechanical Contractor
2. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
    a. By Mechanical Contractor
3. Replace lamps that are burned out or noticeable dimmed by substantial hours of use. Clean light lenses and diffusers.
    a. By Electrical Contractor

END OF SECTION 01 5000

SECTION 01 6000

PRODUCT REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

A. Substitutions Request Procedures.
B. Product Substitutions and Options.

1.2.2 Related Sections include the following:

A. Division 01 7700 Section "Closeout Procedures" for submitting warranties for contract closeout.
B. Divisions 02 0000 through 33 0000 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

1.3.1 Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

A. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
B. New Products: Items that have not previously been incorporated into another project or facility**, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise**. Products salvaged or recycled from other projects are not considered new products.
C. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution,

to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.3.3 Substitutions (after selection of successful bidder): Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3.4 Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3.5 Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

1.3.6 Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

1.4.1 Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

A. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.

B. Form: Tabulate information for each product under the following column headings:

1. Specification Section number and title.
2. Generic name used in the Contract Documents.
3. Proprietary name, model number, and similar designations.
4. Manufacturer's name and address.
5. Supplier's name and address.
6. Installer's name and address.
7. Projected delivery date or time span of delivery period.
8. Identification of items that require early submittal approval for scheduled delivery date.

C. Initial Submittal: Within thirty (30) calendar days after date of “Notice to Proceed,” or date of commencement of work, submit three (3) copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

1. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

D. Completed List: Within sixty (60) calendar days after date of "Notice to Proceed," submit three (3) copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.

E. Architect's Action: Architect will respond in writing to Contractor within fifteen (15) calendar days of receipt of completed product list. Architect's response will include a list of unacceptable product selections without explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

1.4.2 Substitution Requests Procedures: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

A. Substitution Request must be proposed and submitted only to the Construction Manager or General Contractor. Substitution Requests must not be sent directly to the Architect.

B. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

1. Statement indicating why specified material or product cannot be provided.
2. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and other separate Contractors that will be necessary to accommodate proposed substitution.
3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
5. Samples, where applicable or requested.
6. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
7. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

8. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
9. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
10. Cost information, including a proposal of change, if any, in the Contract Sum.
11. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
12. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

C. Architect/Engineer shall have right to reject proposed substitution without explanation.

D. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within Seven (7) calendar days of receipt of a request for substitution. Architect will notify General Contractor or Construction Manager of acceptance or rejection of proposed substitution within Ten (10) calendar days of receipt of request, or Seven (7) calendar days of receipt of additional information or documentation, whichever is later.
1. **Should the Architect not respond within Twelve (12) calendar days of the dated date of Request, the proposed substitution is considered REJECTED.**
2. Form of Acceptance: Construction Change Directive (CCD).
3. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
4. Owner or Architect does not have to give any reason for rejection of substitutions.

1.4.3 Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 3300 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

A. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
B. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

1.6.1 Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

A. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
B. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
C. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
D. Store products to allow for inspection and measurement of quantity or counting of units.
E. Store materials in a manner that will not endanger Project structure.
F. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
G. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
H. Protect stored products from damage.

1.6.2 Owner’s Storage Area: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

1.7.1 Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1.7.2 Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

A. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
B. Refer to Divisions 02 0000 through Divisions 33 0000 Sections for specific content requirements and particular requirements for submitting special warranties.

1.7.3 Submittal Time: Comply with requirements in the following:

A. Division 01 3300 Section “Submittal Procedures.”
B. Division 01 7700 Section "Closeout Procedures.”

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS and SUBSTITUTIONS

2.1.1 General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

A. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
B. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
C. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
D. Where products are accompanied by the term "as selected," Architect will make selection.
E. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
F. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
G. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product acceptable to the Architect.

2.1.2 Product Selection Procedures: Procedures for product selection include the following:

A. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
1. The product is a single source item. Substitutions will not be considered.

B. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
   1. Substitutions may be considered.

C. Manufacturer's Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
   1. Substitutions will not be considered.

D. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
   1. Substitutions by non-listed manufacturers will not be considered.

E. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by a specified manufacturer. Comply with provisions in "Product Substitutions" Article.

F. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, design profiles, dimensions, and other characteristics that are based on the product named.
   1. Provide Basis-of Design product or by one of the listed manufacturers.
   2. Substitutions of other products will not be considered.

G. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
   1. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

H. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
   1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS CRITERIA

2.2.1 Timing: Architect may consider requests for substitution if received within thirty (30) calendar days after the “Notice to Proceed” or before the first (1st) “Application for Payment.” Requests received after that time may be considered or rejected at discretion of Architect without explanation.

2.2.2 Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action or reason, except to record noncompliance with these requirements:

A. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
B. Requested substitution does not require extensive revisions to the Contract Documents.
C. Requested substitution is consistent with the Contract Documents and will produce indicated results.
D. Substitution request is fully documented and properly submitted.
E. Requested substitution will not affect work of other Trades Contractor's construction time schedule.
F. Requested substitution has received necessary approvals of authorities having jurisdiction.
G. Requested substitution is compatible with other portions of the Work.
H. Requested substitution has been coordinated with other portions of the Work.
I. Requested substitution provides specified warranty.
J. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is

uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

2.3.1 Where products or manufacturers are specified by name (except noted as "basis-of-design), submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

A. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
B. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
C. Evidence that proposed product provides specified warranty.
D. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
E. Samples, if requested.

END OF SECTION 01 6000

SECTION 01 7329

CUTTING AND PATCHING

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes procedural requirements for cutting and patching of items indicated but not limited to the following:

A. All Trades Work

1.2.2 Related Sections include the following:

A. Division 2 Section(s) on Selective Demolition
B. Division 7 Section(s) on Firestopping

1.3 DEFINITIONS

1.3.1 Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

1.3.2 Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

1.4.1 Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

1.4.2 Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or results that increase maintenance or decreased operational life or safety.

1.4.3 Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.

1.4.4 Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.5 WARRANTY

1.5.1 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

2. PRODUCTS

2.1 MATERIALS

2.1.1 General: Comply with requirements specified in other Sections.

2.1.2 In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

A. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

3. EXECUTION

3.1 EXAMINATION

3.1.1 Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

A. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
B. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

3.2.1 Temporary Support: Provide temporary support of Work to be cut.

3.2.2 Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.2.3 Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

3.3.1 General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

A. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

3.3.2 Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

A. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
B. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
C. Proceed with patching after construction operations requiring cutting are complete.

3.3.3 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

A. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

B. Exposed Finishes: 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.

1. Clean piping, conduit, and similar features before applying paint or other finishing materials.

2. Restore damaged pipe covering to its original condition.

C. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance.

D. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

E. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

3.3.4 Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 7329

SECTION 01 7400

CLEANING AND DEBRIS CONTROL

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 The Construction Manager (CM) reserves the right to act on behalf of the Owner pertaining to the cleaning and debris control responsibilities that are part of each Contractor's Work. The CM shall also be responsible for the following:

A. Oversee cleaning and ensure that the building and grounds are kept free from accumulation of waste materials, rubbish, debris, dirt and dust.

B. Scheduling exchanges of dumpsters as required.

1.2.2 Daily Cleaning

1.2.3 Routine Cleaning (Weekly)

1.2.4 Final Cleaning

2. PRODUCTS

2.1 SWEEPING COMPOUND

2.1.1 Sweeping Compound shall be used during any and all sweeping procedures. **All Bid Categories are responsible for supplying their own Sweeping Compound.**

3. EXECUTION

3.1 DAILY CLEANING

3.1.1 Each Bid Category Contractor shall execute cleaning to ensure that the building and grounds are kept free from accumulation of waste materials, rubbish, debris, dirt and dust.

A. Daily, during progress of work, each Contractor shall clean site and public properties and dispose of waste materials, debris and rubbish in dumpsters provided by the Construction Manager.

B. Each Contractor shall handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

C. Each Contractor shall provide and maintain garbage cans for the removal of personal trash resulting from breaks and lunches. These are to be emptied on a regular basis.

D. Each Contractor to maintain cleaning throughout the duration of the Project.

3.2 ROUTINE CLEANING (WEEKLY)

3.2.1 On a weekly basis or on a day directed by the Construction Manager, each Contractor shall perform an overall clean-up of the entire site including a broom cleaning of appropriate surfaces. Rubbish and debris shall be removed from the building site to the Owner provided dumpster immediately but no later than the day of weekly cleaning.

A. Each Contractor shall use experienced workmen for cleaning, both in the amount required and for the necessary duration, to maintain the building site in a clean condition, as directed by the CM.

B. Each Contractor shall remove dirt, mud and other foreign materials from all interior and exterior surfaces.

C. Each Contractor to maintain cleaning throughout the duration of the Project.

D. Should the contractor fail in the performance of this Work, the Owner may perform such Work in accordance with Article 3 of the General Conditions.

3.3 FINAL CLEANING

3.3.1 Final Cleaning will be by Owner.

END OF SECTION 01 7400

SECTION 01 7700

PROJECT CLOSEOUT PROCEDURES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

A. Substantial Completion and Inspection procedures.
B. Warranties.
C. List of incomplete items (punch list).
D. Project Record Documents.
E. Operation and maintenance manuals.
F. Demonstration and Training of Owner's Personnel.
G. Final Cleaning.

1.2.2 Related Sections include, but not limited to the following:

A. Divisions 02 0000 through Divisions 33 0000 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

1.3.1 Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

A. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
B. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
C. Utilities. Include occupancy permits, operating certificates, and similar releases.
D. Prepare and submit Project Record Documents, operation and maintenance manuals.

E. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
F. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
G. Complete startup testing of systems.
H. Submit test/adjust/balance records.
I. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
J. Advise Owner of changeover in heat and other utilities.
K. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
L. Complete final cleaning requirements, including touchup painting.
M. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.3.2 Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Construction Manager will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

A. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
B. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 WARRANTIES

1.4.1 All materials and installation have a minimum of a 12 month warranty from the date of substantial completion. Additional warranties are specified in the individual specification sections.

1.4.2 Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

1.4.3 Partial Occupancy: Submit properly executed warranties within fifteen (15) calendar days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

1.4.4 Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

A. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
B. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
C. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

1.4.5 Provide additional copies of each warranty to include in operation and maintenance manuals.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

1.5.1 Preparation: Submit two (2) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

A. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
B. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
C. Include the following information at the top of each page:
1. Project name.
2. Date.
3. Name of Architect and Construction Manager.
4. Name of Contractor.
5. Page number.

1.6 PROJECT RECORD DOCUMENTS

1.6.1 General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

1.6.2 Record As-Built Drawings: Maintain one (1) and submit one (1) set of black-line white prints of Contract Drawings and Shop Drawings to Architect.

A. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

1. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
2. Accurately record information in an understandable drawing technique.
3. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
4. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

B. Mark record sets with non-erasable, red-colored ink. Use other colors to distinguish between changes for different categories of the Work at the same location.

C. Mark important additional information that was either shown schematically or omitted from original Drawings.

D. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

E. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

1.6.3 Record Specifications: Submit one (1) copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

A. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

B. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

C. Note related Change Orders, Record Drawings, and Product Data, where applicable.

1.6.4 Record Product Data: Submit one (1) copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

A. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

B. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

C. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.

1.6.5 Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in

connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

1.7.1 Assemble and submit one (1) complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

A. Operation Manuals:
   1. Emergency and Standard instructions and procedures.
   2. System, subsystem, and equipment descriptions, including operating standards.
   3. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
   4. Description of controls and sequence of operations.
   5. Piping diagrams.

B. Emergency Manuals:
   1. Types of Emergencies: Fire, Flood, Gas leak, Electrical Power Outage, Chemical, Equipment failure and etc.
   2. Instructions and Procedures for Shut-Down and Start-Up.

C. Maintenance Data:
   1. Manufacturer's information, including list of spare parts.
   2. Name, address, and telephone number of Installer or supplier.
   3. Maintenance procedures.
   4. Maintenance and service schedules for preventive and routine maintenance.
   5. Maintenance record forms.
   6. Sources of spare parts and maintenance materials.
   7. Copies of maintenance service agreements.
   8. Copies of warranties and bonds.

1.7.2 Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

3. EXECUTION

3.1 DEMONSTRATION AND TRAINING

3.1.1 Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

A. Provide instructors experienced in operation and maintenance procedures.
B. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
C. Schedule training with Owner, through Construction Manager, with at least seven (7) calendar days' advance notice.
D. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
E. Submit two (2) copies of instructional and demonstration of training procedures.

3.1.2 Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

A. System design and operational philosophy.
B. Review of documentation.
C. Operations.
D. Adjustments.
E. Troubleshooting.
F. Maintenance.
G. Repair.

3.2 FINAL CLEANING

3.2.1 General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations and all other governing agencies having jurisdiction on the project.

A. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project as acceptable to the Architect.
1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove tools, construction equipment, machinery, and surplus material from Project site.
5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
7. Sweep concrete floors broom clean in unoccupied spaces.
8. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
9. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
10. Remove labels that are not permanent.
11. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
12. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
13. Replace parts subject to unusual operating conditions.
14. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
16. Clean ducts, blowers, and coils if units were operated without filters during construction.
17. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
18. Leave Project clean and ready for occupancy.

3.2.2 Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 7700

SECTION 01 7836

WARRANTIES

1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.2.1 This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

A. General close-out requirements are included in Section "Project Close-out."

B. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Division 2-16.

C. Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.

1.2.2 Disclaimers and Limitations – Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporated the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.2.3 Separate Contracts – Each Contractor is responsible for warranties related to its own Contract.

1.3 DEFINITIONS

1.3.1 STANDARD PRODUCT WARRANTIES are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

1.3.2 SPECIAL WARRANTIES are written warranties required by or incorporated in the Contract Documents, either to extend the time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

1.4.1 Related Damages and Losses – When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of the warranted Work.

1.4.2 Reinstatement of Warranty – When Work covered by a warranty has failed and been corrected by replacement or rebuilding; reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

1.4.3 Replacement Cost – Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

1.4.4 Owner's Recourse – Written warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.

1.4.5 Rejection of Warranties – The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

1.4.6 The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

1.5.1 Submit written warranties to the CM prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1.5.2 When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the CM within (15) days of completion of that designated portion of the Work.

1.5.3 The Contractor shall submit a letter of warranty to the Owner, through the CM, which guarantees his workmanship for a period of one year from the completion date of the Contract unless otherwise indicated.

1.5.4 When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification ready for execution by the required parties. Submit a draft to the Owner through the CM for approval prior to final execution.

1.5.5 Form of Submittal – At final completion, compile two copies of each required warranty and bond properly executed by the Contractor, subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the Table of Contents in the Project Manual.

1.5.6 Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring vinyl covered, loose-leaf binders thick enough for the contents and available to receive standard sized paper.

A. Provide heavy paper dividers with celluloid coverd tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product and the name, address, and phone of the installer

B. Identify each binder on the front and the spine with the typed or printed title “Warranties and Bonds” with the Project Title and name of the Contractor.

1.5.7 When Operating and Maintenance Manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

2. PRODUCTS (Not Applicable)

3. EXECUTION

3.1 SCHEDULE OF WARRANTIES

3.1.1 Schedule – Provide warranties and bonds on products and installations as specified in the Technical Specification.

END OF SECTION 01 7836

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SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached - < REQUIRED BY A/E >

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution (if applicable): _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports
< REQUIRED BY A/E >

SUBSTITUTION REQUEST (CONT'D)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E's REVIEW AND ACTION

Note: Should the Architect not respond within Twelve (12) calendar days of the dated date of Request, the proposed substitution is considered rejected.

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Printed name: _____ Title: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E

_____

_____

_____

_____

_____

_____

cc: Technical Specifications Committee

Clawson Public Schools
Districtwide
Remodeling

2014-015, 2014-016, 2014-017, 2014-018
2014-019, 2014-020, 2014-063

01.28.2015

specifications manual

specifications manual
specifications manual
specifications manual
specifications manual

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SECTION 00 8500 – FILE TRANSFER AGREEMENT

PROJECT: DISTRICTWIDE RENOVATIONS
CLAWSON PUBLIC SCHOOLS

PROJECT NO.: 2014-15, -016, -017, -018, -019, -020

FIRM:

TYPE OF WORK:

AGREEMENT FOR THE TRANSFER OF
INSTRUMENTS OF SERVICE

As per your request, and upon approval by our client, we will provide electronic files for your convenience and use in preparing for your specific work related to the above referenced project, subject to the following terms and conditions:

Hard Copy Instruments
These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by us and the electronic files, the signed or sealed hard-copy construction documents shall govern. You are responsible for determining if any conflicts exist. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.

Electronic Data Transfer
Our electronic files are compatible with: *AutoCAD Release 14, Release 2000 and 2003.* We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications. Other software programs may have been used in the development of the drawings and design of the project. French Associates, Inc. (FA) will not release any of this associated software for use with the electronic files.

Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and / or involvement from each electronic display.

Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in preparing your work for the above referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or sub-consultants that may arise out of or in connection with your use of the electronic files.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files.

Computer Viruses
Computer viruses are a real and serious threat to all computer users. FA takes steps to detect and eliminate computer viruses from our system and the diskettes that are made available to our clients and

colleagues. Since computer viruses can attach at any time, FA strongly urges its clients and colleagues to back-up their important data frequently and to take steps to detect viruses from any files that we make available. Even though FA takes prudent steps to prevent the attachment of computer viruses to its electronic media, we cannot guarantee this.

If an electronic file is requested and provided by FA, it is specifically understood and agreed that use of electronic media provided by FA is done so at the sole risk of the user and the user is responsible for testing for and eliminating computer viruses from any files provided by FA.

Service Fee
A service fee of $200 shall be remitted to us prior to delivery of the electronic files.

This file transfer agreement applies to Architectural drawings only. Structural, mechanical, civil, electrical and food service drawing files are the property of our consultants. Arrangements to obtain electronic files of these drawings must be made with them. French Associates makes no commitment that our consultants will make these files available.

Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by us, and we make no warranties, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall we be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

Architect: French Associates, Inc.	Agreed by: (signing below indicates that we have read and agree to both pages of this agreement)
_____ Signature	_____ Signature
_____ Print Name	_____ Print Name
_____ Title	_____ Title
Date: _____	Date: _____

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. Existing Bleachers

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.

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. Soccer goals and footings
2. Infield mix
3. Trees
4. Fencing and footings

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

SECTION 02 4119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:

1. Division 01 1000 Section "Summary" for use of premises, and phasing, and Owner-occupancy requirements.
2. Division 01 5000 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
3. Division 01 7329 Section "Cutting and Patching" for cutting and patching procedures.
4. Division 01 Section "Construction Waste Management and Disposal" for disposal of demolished materials.
5. Division 31 1000 Section "Site Clearing" for site clearing and removal of above and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully

remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1. Coordinate with Owner's archaeologist or historical adviser, who will establish special procedures for removal and salvage.

1.5 SUBMITTALS

A. Qualification Data: For demolition firm, professional engineer and refrigerant recovery technician.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1. Comply with submittal requirements in Division 01 7419 Section "Construction Waste Management and Disposal."

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm in continuous business for at least five (5) years that has specialized in demolition work similar in material and extent to that indicated for this Project.

1. Provide Firm profile and history and a list of Projects including all pertinent information.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 3100 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Division 01 1000 Section "Summary."

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials [**will be removed by Owner before start of the Work**
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

E. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

F. Hazardous Materials: Hazardous materials are present in construction to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

G. Storage or sale of removed items or materials on-site is not permitted.

H. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, preconstruction videotapes and templates.

1. Comply with requirements specified in Division 01 Section "Photographic Documentation."
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES, MECHANICAL and ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

1. Comply with requirements for existing services/systems interruptions specified in Division 01 1000 Section "Summary."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Building manager will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

    a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 5000 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 5000 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 7419 Section "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner or indicated on Drawings.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

F. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weather-tight. Refer to Division 07 Section “Roofing” types for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

1. Discard of refrigerants in compliance to Authorities and Agencies having jurisdiction.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01 7419 Section "Construction Waste Management and Disposal."

B. Burning: Burning of demolished or any materials will not be permitted in Owner’s property.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 4119

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Slabs-on-grade.
3. Concrete curing process and procedures.
4. Curing compounds, sealers and hardeners.
5. Under-slab vapor barriers.

1.3 DEFINITIONS

A. Action Submittals: Mandatory submittals by the Sub-Contractor which require action on the part of the General Contractor, Construction Manager and Design Professional.

1. General Contractor and Construction Manager: Review, Stamp and Forward to the Design Professional.
2. Design Professional: Review, Stamp and Return to the General Contractor or Construction Manager.

B. Informational Submittals: Mandatory submittals by the Sub-Contractor to the General Contractor, Construction Manager and Design Professional which are not returned but kept by each for their project record.

C. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar

diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure and/or floor slabs.

1. Location of construction joints is to be coordinated with control joint layout and is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Qualification Data: For Installer and noted manufacturers.

C. Product Data: For each type of product indicated or proposed for use on the project.

D. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor barriers.
9. Semi-rigid joint filler.
10. Joint-filler strips.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. **Note:** Prior to submittal of proposed mix designs, include aggregate supplier’s service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity (AAR) or alkali silica reactivity (ASR).

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Services

1. The Owner will secure and pay for the services of a qualified, independent materials engineer to perform quality assurance testing of concrete materials, to confirm re-bar placement, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing. Testing Agency shall be acceptable to the architect and the owner and shall be licensed to practice in the state in which the project is located.
2. 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, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. CRSI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. MSP-1, “Manual of Standard Practice.”

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.8 PROJECT CONDITIONS

A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306.

1. Well in advance of proposed concreting operations, advise the architect of planned protective measures including but not limited to heating of materials, heated enclosures, and insulating blankets.

B. Hot-Weather Concreting: Comply fully with the recommendations of ACI 306.

1. Well in advance of proposed concreting operations, advise the architect of planned protective measures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, II or III. At contractor’s option supplement with the following (only if historical mix design break data is available for submittal):

   a. Fly Ash: ASTM C 618, Class C or F.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded - typical except for architecturally exposed concrete. Provide Class 5S for architecturally exposed concrete. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Foundations, Walls and Piers: Nominal Maximum Aggregate Size: 1-1/2 inches.
2. Floor Slabs on Grade: Nominal Maximum Aggregate Size: 1 inch.

C. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 VAPOR BARRIERS

A. Vapor Barrier must meet or exceed the following standards:

1. ASTM E 1745, Class B or better.
2. ASTM E 96 Water Vapor Transmission Rate: Less than or equal to 0.007 Grains/Ft.²/Hr.

B. Available Products:

1. “Stego Wrap 15 Mil. Vapor Barrier” by Stego Industries: (877) 464-7843
2. “Vaporguard” by Reef Industries: (713) 507-4251
3. “Perminator 15 Mil. Under-slab Vapor Barrier” by W.R. Meadows: (800) 214-2100
4. “Reflex 275” by Carlisle Coatings & Waterproofing: (800) 527-7092

C. Accessories

1. Manufacturer's recommended pressure-sensitive seam tape.
2. Manufacturer’s recommended vapor-proofing mastic.
3. Pipe Boots: Construct penetration seals from vapor barrier material, pressure-sensitive seam tape and/or mastic in accordance with the manufacturer’s instructions.

A. Granular Sub-Base: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch sieve, unless otherwise indicated.

1. Products: Subject to compliance with requirements, provide one of the following-

a. Anti-Hydro International, Inc.; Emery.
b. Dayton Superior Corporation; Emery Non-Slip.
c. Emeri-Crete, Inc.; Emeri-Topcrete.
d. Lambert Corporation; EMAG-20.

e. L&M Construction Chemicals, Inc.; Grip It.
f. Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Un-pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

1. Products: Subject to compliance with requirements, provide one of the following-

a. Burke by Edoco; NonMetallic Floor Hardener.
b. ChemMasters; Concolor.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 500.
d. Dayton Superior Corporation; Quartz Tuff.
e. Euclid Chemical Company (The); Surflex.
f. Kaufman Products, Inc.; Tycron.
g. Lambert Corporation; Colorhard.
h. L&M Construction Chemicals, Inc.; Quartzplate FF.
i. MBT Protection and Repair, Div. of ChemRex; Maximent.
j. Metalcrete Industries; Floor Quartz.
k. Scofield, L. M. Company; Lithochrome Color Hardener.
l. Symons Corporation, a Dayton Superior Company; Hard Top.
m. Vexcon Chemicals, Inc.; Durag Premium.

C. Penetrating Liquid Floor Treatment (noted on architectural drawings as Concrete Hardener and Sealer): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following-

a. Burke by Edoco; Titan Hard.
b. ChemMasters; Chemisil Plus.
c. ChemTec International; ChemTec One.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
e. Curecrete Distribution Inc.; Ashford Formula.
f. Dayton Superior Corporation; Day-Chem Sure Hard.
g. Euclid Chemical Company (The); Euco Diamond Hard.
h. Kaufman Products, Inc.; SureHard.
i. L&M Construction Chemicals, Inc.; Seal Hard.
j. Meadows, W. R., Inc.; Liqui-Hard.
k. Metalcrete Industries; Floorsaver.
l. Nox-Crete Products Group, Kinsman Corporation; Duranox.
m. Symons Corporation, a Dayton Superior Company; Buff Hard.
n. US Mix Products Company; US Spec Industraseal.
o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following-

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edoco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div. of ChemRex; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating.

1. Products: Subject to compliance with requirements, provide one of the following-

a. Anti-Hydro International, Inc.; AH Clear Cure WB.
b. Burke by Edoco; Spartan Cote WB II.
c. ChemMasters; Safe-Cure & Seal 20.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
f. Euclid Chemical Company (The); Aqua Cure VOX.
g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
h. Lambert Corporation; Glazecote Sealer-20.
i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
j. Meadows, W. R., Inc.; Vocomp-20.
k. Metalcrete Industries; Metcure.
l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
n. Tamms Industries, Inc.; Clearseal WB 150.
o. Unitex; Hydro Seal.
p. US Mix Products Company; US Spec Hydrasheen 15 percent
q. Vexcon Chemicals, Inc.; Starseal 309.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Review: Do not begin concrete operations until proposed mix has been reviewed by architect.

B. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

C. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

D. Mix design submittal shall include:

1. Project name
2. Project component which pertains to submitted mix design
3. Admixtures
4. Historical break data from past projects on which the proposed mix was used
5. General Contractor or Construction Manager review stamp

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 25 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 75 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Note that fly ash and slag may not be used in any interior or exterior slab on grade or any exposed concrete areas.

F. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

G. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.
4. Use air-entraining admixture in exterior exposed concrete.
5. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Minimum cement content – 470 # /cy, Maximum W/C 0.58
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

B. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Minimum cement content – 517 # /cy, Maximum W/C 0.53
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

C. Exterior Exposed Concrete: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Minimum cement content – 564 # /cy, Maximum W/C 0.45
3. Slump Limit: 4 inches.
4. Air Content: 6 percent, plus or minus 1.0 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch or 3/4-inch nominal maximum aggregate size.

D. Exterior Exposed Concrete – LOW SLUMP: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum cement content – 658 # /cy, Maximum W/C 0.40
3. Slump Limit: 2.5 inches.
4. Air Content: 6 percent, plus or minus 1.0 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch or 3/4-inch nominal maximum aggregate size.

E. Mix Adjustments: Provided that no additional expense to owner is involved, contractor may submit for architect's review requests for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.2 VAPOR BARRIERS

A. Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.
2. Place vapor barrier sheeting with the longest dimension parallel with the direction of the concrete pour.
3. Seal all penetrations using site constructed boots, mastic, pressure-sensitive tape, etc.

B. Course Graded Granular Sub-Base: Install over rough graded building pad.

C. Coordinate installation of vapor barrier and use of blotter course and/or capillary break course with the anticipated construction schedule and ACI 302.1R-96, Figure 1. Plan sufficient time into the project schedule to allow for complete slab curing and drying in order to receive moisture sensitive floor finishes.

D. If the roofing membrane has been installed on the building, the vapor barrier must be placed under a granular blotter course of fine-graded granular material.

1. Fine-Graded Granular Blotter Course: Cover vapor barrier with a 3 inch layer of fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

E. If the roofing membrane has not been installed, the vapor barrier may be placed directly underneath the slab concrete on top of a capillary break course of fine graded material.

1. Fine-Graded Granular Capillary Break Course: Install vapor barrier over a 3 inch layer of fine-graded granular material, moistened and compacted with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Interrupt placement sequence as needed for practical or logistical placement. Install construction joints such that strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. If not indicated, locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction (Control) Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. General: Install and locate joints in concrete slabs according to concrete institute standards and where indicated in the Drawings.
    a. Drawing locations are schematic.
    b. Review and coordinate exact locations with the Architect and proposed joints in finish materials.
2. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
3. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect as part of the original mix design review process.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.

    a. Monitor floor structure deflection during placement and supply concrete in sufficient quantity necessary to achieve specified floor elevations.

4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of

ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 FINISHING - GENERAL

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 FINISHING - FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or mortar setting beds for ceramic or quarry tile, portland cement terrazzo or other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. For distinct rooms or areas greater than 1,500 square feet: Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

3. For distinct rooms or areas less than 1,500 square feet: Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 3/16 inch

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

I. Raked Groove Surface Finish: Install at interior and exterior vehicular traffic ramps and other sloped surfaces where indicated. Provide a ¼ inch deep grooved in a direction to control water downward to the sides/curbs of the slope. Prior to construction, review with Architect for acceptable interpretation of requirements.

3.8 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.9 CONCRETE PROTECTING AND CURING - GENERAL

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 ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Slab on grade to receive rubber, resilient, vct or epoxy flooring must comply with the following requirement prior to flooring installation.
1. Valid and acceptable test results shall be provided to the end user and flooring installer, including the location of all tests, recorded moisture content and temperature of the concrete subfloor prior to flooring installation. Testing shall be confirmed to have been performed at the correct, controlled ambient surface temperature and humidity following the protocol of ASTM F2170- Standard Test Method for determining Relative Humidity in Concrete Floor Slabs Using in situ Probes, using a Wagner Rapid RH probes only. When tested at the correct service temperature and ambient humidity the maximum allowable shall be 85% RH.
   a. Testing may be performed by the flooring installer.

D. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs on temporary formwork, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

E. Unformed Surfaces: Begin curing immediately after finishing concrete.

F. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

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 lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE PROTECTING AND CURING – INTERIOR FLOORS AND SLABS

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Flatwork: Begin curing floors, slabs and concrete floor toppings immediately after finishing concrete.

D. Cure concrete according to ACI 308.1 by:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for three to seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

3.11 LIQUID FLOOR TREATMENTS (CONCRETE HARDENER AND SEALER)

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
4. Install concrete hardener and sealer at all exposed floor surfaces where floors do not receive other finished material.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six month(s) or as long as possible given the project schedule. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through un-reinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around.

Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Construction Manager/Owner will engage a special inspector and/or a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results and Inspection Reports shall be reported in writing to Architect, concrete supplier / manufacturer, Contractor, and Authorities having jurisdiction within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Non-destructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

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. Place top of expansion joint material flush with walk surface, unless noted otherwise on plans.
8. Place reinforcing materials.
9. Place concrete with mechanical vibrators.
10. Consolidate concrete with mechanical vibrators.
11. Round edges of walks and turf anchor at top with finishing tool, ¼" to $^{3}/_{8}$" radius. 1" radius for retaining wall.
12. Finished exposed walk surfaces with wood float followed by brushing with broom, smooth band of 12", unless otherwise shown on drawings.
13. Apply plastic sheeting or curing material and cure for seven (7) days.
14. Replace sections that pocket water.
15. 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 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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SECTION 03 3499 - PRECAST CONCRETE STORAGE BUILDINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Precast and pre-manufactured/site installed concrete storage buildings.

PART 2 - PRODUCTS

2.1 Precast concrete building shall be manufactured by Advance Concrete Products Co., Highland, Michigan - phone (800)824-8351 or approved equal. Manufacturer shall be experienced in manufacturing precast concrete buildings for no less than five years. Manufacturer's production facilities shall be certified by the National Precast Concrete Association for at least five years.

A. Precast concrete building shall be constructed of a minimum of 5,000 psi concrete @ 28 days.

B. Walls shall be minimum 4" thick.

C. Roof shall be 4" thick, with an overhang and drip edge along all (4) walls.

D. Floor shall be minimum 6" thick.

E. All wall joints shall be filled with a clear silicone caulk to guarantee watertightness.

F. Walls shall be attached with heavy duty Flexstrut embedded inserts and connected using spring loaded galvanized steel clips and bolts. Steel angle for connections will be epoxy painted.

G. Exterior finish shall be waterblasted exposed 17A limestone.

H. Vents shall be nominal 16 1/2" x 4 3/4" aluminum with screens.

I. Doors shall be 3' wide each x 6'-8" high, Fiberglass Reinforced Polyester (FRP), with full range of color choice and installed with continuous hinges in 16 gauge steel frame, primed for paint prior to delivery. Prep for mortise lockset by others.

J. Installation: Precast concrete building shall be installed by the manufacturer or under the manufacturer's supervision.

K. Shipping: Precast concrete building shall be transported in such a fashion so as to prevent

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 patter carefully preserved. Joints shall be 3/8" (± 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

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Split-face concrete masonry units.
3. Structural glazed concrete masonry units (Integral ceramic-faced finish)
4. Face brick types (Refer to Drawings).
5. Joint Types.
6. Mortar and grout.
7. Reinforcing steel.
8. Masonry joint reinforcement.
9. Ties and anchors.
10. Embedded metal and thru-wall membrane flashing materials.
11. Miscellaneous masonry accessories.
12. Temporary bracing of masonry walls.

B. Related Sections include the following:
1. Division 07 Section "Water Repellents" for water repellents applied to unit masonry.
2. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
3. Division 07 Section "Penetration Firestopping" for firestopping at tops of masonry walls and at openings in masonry walls.
4. Division 07 Section ‘Joint Sealants” for control joints and expansion joints.
5. Division 07 Section “Expansion Control.”
6. Division 08 Section "Louvers and Vents" for wall vents.

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.

B. Determine net-area compressive strength (f’m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in Section 1.4 of the ACI 530.1/ASCE 6/TMS 602 Specification for Masonry Structures (the **MSJC Code**). Provide f’m for concrete masonry construction according to the following:

Use	Compressive Strength, f'm (psi)	Unit Strength (psi)	Grout Strength (psi)	Mortar Type
Typical, unless noted otherwise	1500 min.	1900 min.	2000 min.	M or S
Walls, Piers, Pilasters > 24 ft. high	2000 min.	2800 min.	2500 min.	M or S
Columns	2500 min.	3750 min.	3000 min.	M or S

C. Masonry Inspection Requirements:

[**Testing Frequency for Non-Essential Facilities - Level B Quality Assurance:**

a. **Assurance level to be in accordance with Table 4 of the MSJC Specification for Masonry Structures.**

b. **Frequency level for Category I, II or III buildings to be in accordance with Table 1704.5.1 Level 1 Special Inspections of the Michigan Building Code.]**

2. For this project, the testing and inspecting agency will be hired by the Owner or the Owner's representative.
3. Contractor may retain a qualified consultant to review procedures and construction methods to comply with this specification, industry standards and construction codes.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

C. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Verification: For the following:

1. Full-size units, if requested, for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project**.** Provide mix data.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.

a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in Section 1.4 of **the MSJC Code**.
4. Each combination of masonry unit type and mortar type specified to be manufactured with integral water repellant.
5. Each material and grade indicated for reinforcing bars.
6. Each type and size of joint reinforcement.
7. Each type and size of anchor, tie, and metal accessory.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in Section 1.4 of **the MSJC Code**.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

J. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with hot-weather requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Services

1. The Construction Manager/Owner will secure and pay for the services of a qualified, independent materials engineer to perform quality assurance testing of mortar and grout materials, to confirm re-bar and anchorage placement, to verify compliance of materials with specified requirements, to observe and document compliance with hot and cold weather construction methods, and to perform required field and laboratory testing. Testing Agency 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. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

C. Masonry Standard: Comply with **the MSJC Code** unless modified by requirements in the Contract Documents.

D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

E. Source Limitations 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.

F. Preconstruction Testing Service: Owner may engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
4. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
5. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.

G. Construction Testing Service: Refer to Article 3.15 “Field Quality Control” herein.

H. 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.

1. UL-Design No. U905: 2 hour rating. 6” (5-5/8”) nominal thick concrete block (CMU) bearing and non-bearing fire-rated wall construction.
2. UL-Design No. U906: 2 hour rating. 8” (7-5/8”) nominal thick concrete block (CMU) bearing and non-bearing fire-rated wall construction.
3. UL-Design No. U907: 3 and 4 hour rating. 8” (7-5/8”) nominal thick concrete block (CMU) non-bearing fire-rated wall construction. Comply with CMU fabrication criteria.

I. Mockups: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Locate mockups in the locations as directed by Construction Manager or Architect.
2. Build mockups for the following types of masonry in sizes approximately 48 inches (12 long by 48 inches high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches long in each mockup.

a. Typical exterior wall with lower corner of window opening framed with cast stone trim and through-wall flashing.
b. Provide through-wall flashing to 16 inches above the ground floor line.
c. Provide mortar-net at least 10 inches high or 4 inches (minimum) deep of washed pea gravel at the bottom of the weep hole line.
d. Provide at least 2 inches of rigid insulation on the back-up cavity CMU wall with all insulation joints taped.

3. Notify Architect seven (7) calendar days in advance of dates and times when mockups will be constructed.
4. Acceptance of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship and does not constitute approval of deviations from the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units and other material accessories on elevated platforms in a dry location, cover tops and sides of stacks with waterproof sheeting, securely tied.

1. Protect Type-1 concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover masonry when construction is not in progress.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three (3) calendar days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with other installed materials.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with the cold-weather construction requirements contained in Section 1.8C of **the MSJC Code**.

1. General: Comply with the following construction procedures for masonry construction, based on air temperatures at time of installation. When the ambient temperature is below 40 degrees F, implement cold weather procedures and comply with the following:

a. Do not lay glass unit masonry.

2. **Preparation** – comply with the following requirements prior to conducting masonry work:

a. Do not lay masonry units having either a temperature below 20 degrees F or containing frozen moisture, visible ice, or snow on their surface.
b. Remove visible ice and snow from the top surface of existing foundations and masonry to receive new construction. Heat and maintain these surfaces above freezing, using methods that do not result in damage.

3. **Construction** – These requirements apply to work in progress and are based on ambient air temperatures. Do not heat water or aggregates used in mortar or grout

above 140 degrees F. Comply with the following requirements during construction when the following ambient air conditions occur:

a. 40 degrees F to 32 degrees F:

1) Mortar: Heat sand and mixing water to produce mortar with temperature between 40 degrees F and 120 degrees F at the time of mixing.
2) Grout and Units: Heated materials not required unless temperature falls below 32 degrees F.

b. 32 degrees F to 25 degrees F:

1) Mortar: Heat sand and mixing water to produce mortar with temperature between 40 degrees F and 120 degrees F. Maintain mortar temperature temperatures above 40 degrees F until used in masonry.
2) Grout – Heat grout aggregates and mixing water to produce grout with temperature between 70 degrees F and 120 degrees F. Maintain grout temperature above 70 degrees F at the time of grout placement.
3) Units – Heat units to a minimum temperature of 32 degrees F at the time of placement.

c. 25 degrees F to 20 degrees F:

1) Mortar: Heat sand and mixing water to produce mortar with temperature between 40 degrees F and 120 degrees F. Maintain mortar temperature temperatures above 40 degrees F until used in masonry.
2) Grout – Heat grout aggregates and mixing water to produce grout with temperature between 70 degrees F and 120 degrees F. Maintain grout temperature above 70 degrees F at the time of grout placement.
3) Units – Heat units to a minimum temperature of 40 degrees F at the time of placement.
4) Provide wind breaks or enclosures when wind velocity exceeds 15 MPH.
5) Heat constructed masonry to 40 degrees prior to grouting.

d. 20 degrees F and below:

1) Mortar: Heat sand and mixing water to produce mortar with temperature between 40 degrees F and 120 degrees F. Maintain mortar temperature temperatures above 40 degrees F until used in masonry.
2) Grout – Heat grout aggregates and mixing water to produce grout with temperature between 70 degrees F and 120 degrees F. Maintain grout temperature above 70 degrees F at the time of grout placement.
3) Units – Heat units to a minimum temperature of 40 degrees F at the time of placement.
4) Provide an enclosure with auxiliary heat to maintain air temperature of 32 degrees within the enclosure.
5) Heat constructed masonry to 40 degrees prior to grouting.

e. Grouted construction: On any day when the anticipated nighttime temperature is 32 degrees F or less, in addition to complying with general procedures above, heat grout materials between 90 degrees F and 120 degrees to produce in-place grout temperature of not less than 70 degrees F at end of work day.

f. Clay masonry units: Comply with the following requirements for clay masonry units which must be wetted before laying because initial rate of absorption (suction) greater than 1 gram per square inch per minute (ASTM C 67):

1) Surface temperatures above 32 degrees F: Sprinkle with water heated to 70 degrees F or above, just before laying.
2) Surface temperatures below 32 degrees F: Sprinkle with water heated to 130 degrees F or above, just before laying.

g. Water: Do not heat water for mortar or grout to more than 160 degrees F.

h. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and above and will remain so until masonry has dried, but not less than seven (7) calendar days after completing cleaning.

4. **Protection** – These requirements apply after masonry is placed and are based on anticipated minimum daily temperature. Protect completed masonry in the following manner:

a. Maintain the temperature of unit masonry above 40 degrees F for the first 48 hours after construction.

b. 40 degrees F to 25 degrees F:

1) Protect newly constructed masonry by covering with a weather-resistive membrane for 24 continuous hours after being completed.

c. 25 degrees F to 20 degrees F:

1) Cover newly constructed masonry completely with weather-resistive insulating blankets for 48 continuous hours.

d. 20 degrees F and below:

1) Maintain newly constructed masonry temperature above 32 degrees F for at least 48 continuous hours after being completed by using heated enclosures and a continuous heat source such as heaters, electric heating blankets, infrared lamps, etc.

e. Grouted construction: On any day when the anticipated nighttime temperature is 32 degrees F or less, in addition to complying with general procedures above, provide insulating blankets and heated enclosures for not less than 72 continuous hours and longer if conditions threaten completed work.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Comply with the hot-weather construction requirements contained in Section 1.8D of **the MSJC Code**.

1. General: Comply with the following construction procedures for masonry construction, based on air temperatures at time of installation. When the ambient temperature is 100 degrees F, or exceeds 90 degrees F with a wind velocity greater than 8 MPH implement hot weather procedures and comply with the following:

2. **Preparation** – comply with the following requirements prior to conducting masonry work:

a. Maintain sand piles in a damp, loose condition.

b. Provide necessary conditions and equipment to produce mortar having a temperature below 120 degrees F.

c. When the ambient temperature exceed 115 degrees F, or exceeds 105 degrees F with a wind velocity greater than 8 MPH, shade materials and mixing equipment from direct sunlight.

3. **Construction** – These requirements apply to work in progress and are based on ambient air temperatures. Comply with the following requirements during construction when the following ambient air conditions occur:

a. When the ambient temperature is 100 degrees F, or exceeds 90 degrees F with a wind velocity greater than 8 MPH:

1) Maintain temperature of mortar and grout below 120 degrees F.

2) Flush mixer, mortar transport container, and mortar boards with cool water before they come in contact with mortar ingredients or mortar.

3) Maintain mortar consistency by re-tempering with cool water.

4) Use mortar within 2 hours of initial mixing.

5) Do not spread mortar beds more than 48 inches ahead of units. Set masonry units within one minute of spreading mortar.

b. When the ambient temperature exceed 115 degrees F, or exceeds 105 degrees F with a wind velocity greater than 8 MPH:

1) Implement the requirements of E.3.a above and use cool mixing water for mortar and grout. Ice is permitted in the mixing water prior to use. Do not permit ice in the mixing water when added to the other mortar or grout materials.

4. **Protection** – These requirements apply after masonry is placed and are based on the average daily temperature. Protect completed masonry in the following manner:

a. When the mean air temperature is 85 degrees F or above, if relative humidity is less than 30 percent or if wind velocity is in excess of 15 MPH:

1) Provide protection by immediately covering newly constructed walls, by providing wind breaks, or by using fog spray to reduce rate of evaporation.

b. When the mean daily temperature exceeds 100 degrees F, or exceeds 90 degrees F with a wind velocity greater than 8 MPH:

1) Fog spray newly constructed masonry until damp, at least three times a day until the masonry is three days old.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

B. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners, unless otherwise noted.

C. CMU-1: Standard Finish Concrete Masonry Units - for interior locations only - comply with ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength specified under the Performance Requirements of Article 1.4.B above.
2. Weight Classification:

    a. Exterior Walls: Normal or Medium weight – Cavity/Veneer Walls Only
    b. Exterior Walls: Normal weight – Singly Wythe Walls
    c. Interior Load or Non-Load Bearing Walls: Normal or Medium weight.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.2 CONCRETE AND MASONRY LINTELS

A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.

B. Precast Concrete Lintels: Precast units made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by same method used for concrete masonry units.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete." Use in hidden or un-exposed conditions only.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

D. Mortar Cement: ASTM C 1329.

E. Masonry Cement: ASTM C 91.

1. For pigmented mortar, use a colored cement formulation as required to produce the color indicated or, if not indicated, as selected from manufacturer's standard formulations.
2. For colored-aggregate mortar, use natural color or white cement as necessary to produce required mortar color.

F. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

1. White-Mortar Aggregates: Natural white sand or ground white stone.
2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

2.4 REINFORCEMENT

A. Un-coated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
5. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement, Stainless Steel: ASTM A 580, Type 304.

1. Swimming Pool, Spa and Chemical Storage Room Walls: Stainless steel.

2.5 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

B. Swimming Pool, Seating Area, Locker Room, Chemical Storage Room: Provide stainless steel tie and anchor sections on interior side of wall assembly.

1. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 153, Class B-2 coating.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
3. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.

4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
5. Stainless-Steel Sheet: ASTM A 666, Type 304.
6. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
7. Stainless Steel bars: ASTM A 276 or ASTM a 666, Type 304.

2.6 BENT WIRE TIES

A. General: Rectangular units with closed ends and not less than 4 inches wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches.
2. Where wythes are of different materials, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches.

B. Wire: Fabricate from 3/16-inch-diameter, hot-dip galvanized steel wire.

2.7 RIGID ANCHORS

A. General: Fabricate from steel bars as follows:

1. 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins.
2. Finish: Hot-dip galvanized to comply with ASTM A 153.
3. Weld to structural steel frame.

2.8 INTERSECTING WALL ANCHORS

A. General: Fabricate steel bars as follows:

1. 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins.
2. Finish: Hot-dip galvanized to comply with ASTM A 153.
3. Lay-up in alternate courses between adjacent intersection walls which are not interlocked or at control joint locations.

2.9 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

B. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336-inch, galvanized steel sheet.

C. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C.

D. Post-installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Expansion or Adhesive anchors.
2. Type: Undercut anchors.
3. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
4. For Post-installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
5. For Post-installed Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.10 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim" and below:

1. Stainless Steel Flashing: Provide 0.0156 inch thick. Install where in direct contact with aluminum or stainless steel materials.
   a. Provide at Fully-concealed and at Exposed locations.

2. Fabricate through-wall metal flashing embedded in masonry from sheet metal indicated above and with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond. Length of flashing shall be at least 4 inches past the opening and more to cover any lintels.
3. Fabricate metal drip edges from sheet metal indicated above. Extend at least 3 inches into wall and 1/2 inch out from wall, with a hemmed outer edge bent down 30 degrees.
4. Fabricate metal flashing terminations from sheet metal indicated above. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and then down into joint 3/8 inch to form a stop for retaining sealant backer rod.
5. Provide and adhere metal water drip edge under flashing and projecting past face of masonry surface.

B. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Metal Flashing Manufacturers: Manufacturers indicated in this part of the Specifications and other Manufacturers acceptable to the Architect.

C. Partly-exposed Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above in “Embedded Flashing Materials.” For flashing not exposed to the exterior elements, use one of the following, unless otherwise indicated:

1. Provide flashing as a complete system with preformed corners, end dams, other special shapes, and seaming materials; all produced by flashing sheet manufacturer.

2. Fully Concealed Thru-Wall Membrane Flashing: Contractor shall provide one of the flashing material types listed. Provide adhesive-set thru-wall membrane flashing at all masonry material types above foundation walls to at least 16 inches above the ground floor line. Install under window sills, lintels, parapet walls and at single-wythe Concrete Masonry Units above the foundation walls and other areas indicated. Provide water edge drip of compatible metal, adhered under the flashing and bent down the face of the masonry units to direct water away from the masonry joints.

a. Rubberized-Asphalt Flashing: Manufacturer's composite flashing of adhesive-set rubberized-asphalt compound, bonded to high-density, cross-laminated polyethylene film. Note: Use only where flashing is fully concealed in masonry.

1) Dur-O-Barrier; Dur-O-Wall, Inc.
2) Perm-A-Barrier Wall Flashing; W.R. Grace & Co.
3) Other Manufacturer's Product acceptable to the Architect.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

F. Exposed Metal Drip Edges: All metal drip edges shall comply with the following: Hemmed exposed edges, laps utilizing non-skinned butyl sealant, and a compatible sealant where the underside of the hem transitions to the substrate below.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane.

B. Preformed Control-Joint: Material designed to fit standard sash block and to maintain lateral stability in masonry wall and designed to allow for movement.

1. PVC: ASTM D 2287, Type PVC-65406.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.187-inch steel wire, hot-dip galvanized after fabrication.

1. Provide units with either two loops or four loops as needed for number of bars indicated.
2. Reinforcing Bar Positioners Manufacturer:

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.12 MASONRY CLEANERS

A. Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:

a. "Sure Klean No. 600 Detergent"; ProSoCo, Inc.
b. Other manufacturers complying with Specifications.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. For un-reinforced masonry, use portland cement-lime, masonry cement or mortar cement mortar.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced or un-reinforced masonry not in contact with earth, use Type M or S.
3. For mortar parge coats, use Type S.
4. For interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N. Coordinate with architectural requirements for veneer mortars.

D. Mortar/Grout Colors:

1. Provide standard grey matching concrete masonry unit colors unless otherwise indicated.
2. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 7 of the **MSJC Code** for dimensions of grout spaces and pour height. Fine grout shall not be used unless absolutely necessary to comply with Table 7.
2. Proportion grout in accordance with ASTM C 476, Paragraph 4.2.2 for specified 28-day compressive strength indicated by Article 1.4.B Performance Requirements of this specification.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

2.14 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C 67.

C. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Field apply water repellent on exterior surfaces of single-wythe masonry units' construction.

C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

E. Use full-size units without cutting. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

G. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

H. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

I. Comply with construction tolerances in the **MSJC Code** and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and at other locations.

B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

E. Fill space between hollow-metal frames and masonry solidly with mortar.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

G. Install reinforcing bar positioners in locations coordinated with the vertical reinforcement spacing. Positioners shall be located accurately to install reinforcement bars in the center of the unit core or offset as specified on the Drawings.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items. Fill cores at anchors and embedded items.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 8446 Section "Fire-Resistive Joint Systems."

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Mortar/Grout Joint Types: Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

1. Provide tooled joints (concave) unless otherwise indicated.
2. Other joint types – flushed, raked, struck will be indicated on the Drawings.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated in Drawings but not spaced more than 30'-0" apart. Build-in related items as masonry progresses. Do not form a continuous span through movement joints. Verify control joint locations with Architect.

B. Form control joints in concrete masonry as follows using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Location and spacing of control joints shall comply with industry standards.

C. Form expansion joints in brick made from clay or shale as follows:

1. Build flanges of factory-fabricated, expansion-joint units into masonry.
2. Form open joint of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

D. Build in horizontal, pressure-relieving joints where required and indicated; construct joints by either leaving an air space or inserting a compressible filler of width required."

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.7 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

1. Where 8 inches of bearing is not available at jambs, provide additional jamb reinforcement to obtain adequate structural bearing capacity.

3.8 FIELD QUALITY CONTROL

A. Inspectors: Construction Manager/Owner will engage a qualified, independent agency to perform field inspections and prepare inspection reports.

B. Testing: Construction Manager/Owner will engage a qualified, independent agency to perform field tests indicated below and prepare test reports.

C. Quality Assurance Level and Frequency:

[**Testing Frequency for Non-Essential Facilities - Level B Quality Assurance:**

a. **Assurance level to be in accordance with Table 4 of the MSJC Specification for Masonry Structures.**

b. **Frequency level for Category I, II or III buildings to be in accordance with Table 1704.5.1 Level 1 Special Inspections of the Michigan Building Code.]**

[**Testing Frequency for Essential Facilities - Level C Quality Assurance:**

c. **Assurance level to be in accordance with Table 5 of the MSJC Specification for Masonry Structures.**

d. **Frequency level for Category IV buildings to be in accordance with Table 1704.5.3 Level 2 Special Inspections of the Michigan Building Code.]**

e. Note: The **MSJC and Michigan Building Codes** require inspectors to observe all grouting operations continuously. Communication with inspector is the contractor's responsibility. Grouting shall not proceed until the inspector is onsite and has made the required pre-grouting observations.

f. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

g. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, locations and position of reinforcement.

D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.

E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780.

G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

H. Testing agency will report results of tests and inspections promptly, in detail and in writing to Contractor, Architect and authorities having jurisdiction.

I. Remove and replace work that does not comply with specified requirements.

J. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units.

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

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

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with nonmetallic scrape hoes or chisels.
2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
3. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.10 MASONRY WASTE DISPOSAL

A. Waste Disposal: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove and dispose of legally from Project site.

END OF SECTION 04 20 00

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Ceiling joist framing.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As follows:

a. Single member Ceiling/Soffit Joists Dead Loads: 10 psf
b. Single member Ceiling/Soffit Joists Live Loads: 30 psf

c. Wind Loads: per ASCE 7-05, based on 90 mph wind speed, Exposure C, Components and Cladding:
1) Wall Component Maximum = 22.4 PSF
2) Roof Component (50 Sq. Ft.) Maximum = +11.5 PSF, -25.4 PSF
3) Roof Overhang Component (50 Sq. Ft.) Maximum = -38.6 PSF

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
a. Ceiling/Soffit Joist Framing: Vertical deflection of 1/360 of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 3/4 inch.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: For each type of cold-formed metal framing product and accessory indicated.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.
21. Unimast, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60, A60, AZ50, or GF30 typically.
3. Coating: G90 or equivalent for backup of masonry.

B. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

2.3 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required to sustain design loads, but not less than 0.0329 inch.

2. Select one flange width from subparagraph below. Flange widths may vary with application. Sequence corresponds to new common flange width designators 162, 200, and 250.
3. Flange Width: 1-5/8 inches, minimum.

2.4 HEADERS

A. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required to sustain design loads, but not less than 0.0428 inch.
2. Flange Width: 1-5/8 inches.

B. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:

1. Minimum Base-Metal Thickness: As required to sustain design loads, but not less than 0.0428 inch.
2. Top Flange Width: 1-1/2 inches.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Undercut and Adhesive: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Non-metallic, Non-shrink Grout: Premixed, nonmetallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multi-monomer plastic, non-leaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As indicated or required to sustain design loads.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.5 FIELD QUALITY CONTROL

A. Testing and Inspections: Construction Manager/Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Framing configuration and connections will be subject to inspections:

1. Inspector is to confirm general compliance of the framing configuration with the approved shop drawings including but not limited to framing sizes, gage metal thickness, and spacing.
2. Movement joints are to be inspected to confirm zone of free movement.
3. Connections are to be reviewed to confirm compliance of screw count and configuration with the approved shop drawings.
4. The final Inspection Report shall note compliance with the construction documents and the approved shop drawings.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Test results and Inspection Reports shall be reported in writing to Architect, Contractor, and Authorities having jurisdiction within 48 hours of testing or inspection.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Joist or Beam Reinforcement.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Shelf angles.
6. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.3 DEFINITIONS

A. Action Submittals: Mandatory submittals by the Sub-Contractor which require action on the part of the General Contractor, Construction Manager and Design Professional.

1. General Contractor and Construction Manager: Review, Stamp and Forward to the Design Professional.
2. Design Professional: Review, Stamp and Return to the General Contractor or Construction Manager.

B. Informational Submittals: Mandatory submittals by the Sub-Contractor to the General Contractor, Construction Manager and Design Professional which are not returned but kept by each for their project record.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and

other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 ACTION SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.

1.6 INFORMATIONAL SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.9 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A992, Grade 50.

B. Steel Tubing: ASTM A 500, Grade B cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: 1-5/8
2. Depth of Channels: As required by field and framing conditions.
3. Material: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, with G90 coating.
4. Nominal thickness: As required by field and framing conditions.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Structural steel bolts, ASTM A325, Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

D. Lag Bolts: ASME B18.2.1.

E. Wood Screws: Flat head, ASME B18.6.1.

F. Plain Washers: Round, ASME B18.22.1.

G. Undercut or Adhesive Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 JOIST OR BEAM REINFORCEMENT

A. General: Fabricate material in lengths manageable at the site. Splices of material shall be made with full penetration welds or other as reviewed in advance by the Engineer of Record.

1. Coordinate material lengths with access logistics. Headroom or other access limitations may require Substitutions of plates or shapes with other plates or shapes of nominally equal weight. Substitutions must be reviewed by the Engineer of Record prior to fabrication.

B. Field verify web and chord configurations of existing joists to be reinforced. Configurations indicated on the Drawings are diagrammatic only which indicate only the extent of web and chord reinforcement. Other configurations may exist, i.e. panel dimensions may be different and there may be more verticals and diagonals than shown on the Drawings, but nonetheless all web members within the zone indicated are to be reinforced.

1. The shape of the existing chords or web members may require Substitutions of plates or shapes with other plates or shapes of nominally equal weight. Substitutions must be reviewed by the Engineer of Record prior to fabrication.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.

2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for ceiling-hung toilet compartments from continuous steel beams or channels of sizes indicated with attached bearing plates, anchors, and braces as indicated.

D. Galvanize miscellaneous framing and supports where exposed to the elements such at the Building Exterior as well as interior locations which are humid or corrosive.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.9 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING JOIST AND BEAM REINFORCEMENT

A. General: Install reinforcement material to comply with the strengthening requirements indicated on the Design Drawings.

B. Prior to welding new material to existing surfaces, thoroughly clean all surfaces to remove rust, paint, dirt, mill scale or other foreign matter in the weld area.

C. All field welds shall be cleaned of slag and scale and inspected by the site quality assurance inspector.

D. Prime paint welds after welding passes inspection.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 5000

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Wood-Preservative Treated Lumber
   2. Fire-Retardant Treated Materials.
   3. Plywood backing panels.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. RIS: Redwood Inspection Service.
   4. SPIB: The Southern Pine Inspection Bureau.
   5. WCLIB: West Coast Lumber Inspection Bureau.
   6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat all rough carpentry, unless otherwise indicated.

1. Wood cants, nailers, curbs, equipment support bases, 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 and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use Exterior type for exterior locations and elsewhere, where indicated.
2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
3. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

C. Application: Treat all rough lumber that is not exposed to view.

1. Provide fire treated wood/lumber in all areas and locations required by Building Codes and other Agencies having jurisdiction.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with fifteen (15) percent maximum moisture content of any species.

C. For items of dimension lumber size, provide Construction or No. 2 grade lumber with nineteen (19) percent maximum moisture content:

D. For exposed boards, provide lumber with nineteen (19) percent maximum moisture content Construction Grade No. 2:

E. For concealed boards, provide lumber with fifteen (15) percent maximum moisture content Construction grade stud or No. 3:

F. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

G. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

H. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated**,** in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.10 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

D. Do not splice structural members between supports, unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
4. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
5. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

I. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable.
2. Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 PROTECTION

A. Protect rough carpentry from weather. Should rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1000

TURF ANCHOR

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

1.2 SCOPE

A. Provide all material, labor, and equipment necessary to install the timber and cleanup as detailed on the drawings and herein.

B. Work includes:

1. Demolition
2. Excavation
3. Grading
4. Wood Nailer
5. Restoration and General Clean-Up

PART 2 - PRODUCTS

2.1 TIMBER EDGING

A. Southern Pine or Douglas Fir pressure preservative treated with alkaline copper quaternary (ACQ) or Copper Azole (CA) preservatives in accordance with American Wood Preservers Associates (AWPA) standard C17 for ground contact use. Provide lumber sizes as indicated on drawings.

B. All hardware shall meet a minimum requirement established ASTM standard A153 and ASTM standard A653 (Class G-185).

2.2 WOODEN NAILER FASTENERS

A. Nails 16 d Hot Dipped Galvanized

B. ¼ x 2 ¾" Stainless Steel Tapcon Masonry Screws

C. DEC-King Exterior Wood Screw with Climacoat

D. Wood to-Metal TEKS with Grey Spex

E. Tapcon Concrete Anchor with Blue Climaseal and White Ultrashield

F. Roofgrip with Spex or Blue Climaseal

G. GYP-FAST Nail with Climacoat

H. Maxi-set Tapcon White UltraShield

I. Ramguard Drive Pin

PART 3 - EXECUTION

3.1 DEMOLITION, EXCAVATION AND REMOVALS

A. Strip all existing topsoil, infield mix, etc. from work area. Stockpile sufficient material for restoration of perimeter area. Legally dispose of excess material off site.

3.2 GRADING

A. Grade area to elevations and slopes as indicated on the drawings. Grade shall be such that when finished grade is established, the work area and the perimeter shall be free of standing water.

3.3 INSTALLATION OF TIMBER EDGING

A. Install wood nailer using only the specified fasteners listed in Section 2.2 above.

B. Fasteners shall be placed in the middle (vertical) of nailer board. Fastener shall be no closer than 6” from end of board.

C. Fasteners spacing shall not be more than 2.5’

D. Contractor shall maximize use of treated lumber and minimize cuts to corners.

3.4 RESTORATION AND CLEAN UP

A. Clean-up all excess materials and remove from site. Adjoining areas to be the same as prior to construction, and properly graded to allow water to drain away from surface.

END OF SECTION 06 1050

SECTION 06 1600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to the following:

1. Wall sheathing types.
2. Sheathing paper and building wrap.
3. Sheathing joint-and-penetration treatment.
4. Flexible flashing at openings in sheathing.

B. Related Sections include the following:

1. Division 06 1000 Section "Rough Carpentry".

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual."

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 108 inches (1219 by 2743 mm) for vertical installation.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.

2.3 INFILTRATION BARRIER

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Install over all exterior wall sheathing.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
b. DuPont (E. I. du Pont de Nemours and Company); Tyvek **CommercialWrap**.

3. Water-Vapor Permeance: Not less than 125 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
4. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced or Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

B. Sealant for Paper-Surfaced or Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

C. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

D. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.5 MISCELLANEOUS MATERIALS

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

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than **0.030 inch (0.8 mm)**.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; **Vycor Plus Self-Adhered Flashing**.
c. MFM Building Products Corp.; Window Wrap.
d. Polyguard Products, Inc.; Polyguard 300.

C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects or pieces that are too small. Install with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
4. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

5. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
4. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.3 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Paper and Building Wrap: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal all penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal all penetrations and openings.
3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.5 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Install and prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
4. Lap weather-resistant building paper over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.6 PROTECTION

A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing.

END OF SECTION 06 1600

SECTION 06 4023 - INTERIOR ARCHITECTURAL WOODWORK
CUSTOM-BUILT MILLWORK AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate cabinets (custom-built).
   2. Plastic-laminate countertops and sills

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories, handrail brackets and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
   3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
   4.

C. Samples for Verification:
   1. Plastic laminates, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
   2. Solid-surfacing materials, 6 inches (150 mm) square.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop in continuous business at least five (5) years that employs skilled workers who custom-fabricate products similar to those required for this Project and

whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Source Limitations: Engage a qualified woodworking firm in continuous business at least five (5) years to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
3. Forward advance information for embedded items to the project for installation.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's, WIC's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish:

1. Red Oak – rift-cut.

C. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Softwood Plywood: DOC PS 1**,** Medium Density Overlay.
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, provide high-pressure decorative laminates one of the following:

a. Arborite; Division of ITW Canada, Inc.
b. Formica Corporation.
c. Lamin-Art, Inc.
d. Nevamar Company, LLC; Decorative Products Div.
e. Panolam Industries International Incorporated.
f. Wilsonart International; Div. of Premark International, Inc.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
2. Interior Type A: Low-hygroscopic formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
5. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

1. Product: Subject to compliance with requirements, provide "Duraflake FR" by Weyerhaeuser.

D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

1. Product: Subject to compliance with requirements, provide "Medite FR" by SierraPine Ltd.; Medite Div.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Butt Hinges: 2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Catches: Satin chrome finish, roller catches, BHMA A156.9, B03071.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.

F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

G. Drawer Slides: BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:

1. Box Drawer Slides: Grade 1HD-100.
2. File Drawer Slides Grade 1HD-200.
3. Pencil Drawer Slides: Grade 1.
4. Keyboard Slides: Grade 1HD-100.

H. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

I. Door Locks: BHMA A156.11, E07121, at all doors.

J. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage. Color to match adjacent material colors.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. .
2. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated hardwood or softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for 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 sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. 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 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven (7) days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-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. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of clear varnish.

G. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.6 CUSTOM-BUILT WOOD CABINETS FOR STAINED OR TRANSPARENT FINISH

A. Grade: Premium.

B. Door and Drawer Front Style: Flush overlay, unless otherwise indicated.

C. Reveal Dimension: As indicated.

D. Wood Species and Cut for Exposed Surfaces: **Red oak, plain sawn**

1. Grain Direction: Continuous vertical figure across doors of individual cabinets; drawer fronts may be horizontal, but direction must be consistent.
2. Matching of Veneer Leaves: Book match.
3. Vertical Matching of Veneer Leaves: End match.
4. Veneer Matching within Panel Face: Running match.

5. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.
6. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.

E. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces, Thermoset decorative panels.
2. Drawer Sides and Backs: **Solid-hardwood lumber**.
3. Drawer Bottoms: **Hardwood plywood**.

F. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.7 CUSTOM-BUILT PLASTIC-LAMINATE CABINETS (BASE AND WALL CABINETS, FURNITURE, ETC.)

A. Grade: Custom.

B. Door and Drawer Front Style: Flush overlay, unless otherwise indicated.

1. Provide “felt” silencers.
2. Provide cabinet locks, where indicated.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: PVC T-mold matching laminate in color, pattern, and finish, unless otherwise indicated.

D. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

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

1. As selected by Architect from laminate manufacturer's full range:

G. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

H. Fabricate/Construct woodwork to details indicated on Drawings.

1. AWI Type of cabinet construction.

2.8 CUSTOM-BUILT PLASTIC-LAMINATE COUNTER TOPS AND SILLS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces.

1. Refer to Room Finish Schedule.

D. Grain Direction: Parallel to cabinet fronts.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Exterior-grade plywood.

G. Core Material at Sinks: Exterior-grade plywood.

H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of counter top substrate.

I. Counter Tops and Backsplashes:

1. Counter Tops – surfaces and edge-band on exposed edges with 1/16” plastic laminate over particleboard core, thickness after lamination 1-1/8 inch thick, or thicker as indicated. Shop fabricate tops using one-piece whenever possible and no transverse joints permitted with 24” of counter sinks.

a. Front edge-band shall be rounded 3 mm PVC strip flush with top counter surface and rounded underside flush with bottom of counter top.
b. Fabricate/Construct to details indicated on Drawings.

2. Exposed front corner edges of counter tops shall be rounded with ½” minimum and 1” maximum radius at corners when counter tops are not abutting walls.
3. Backsplash and Ends: Provide 4” x 5/8” high backsplash unless otherwise noted, and ends on all counter units to match counter top for job site installation.
4. Contractor’s Option: “Post-formed” backsplashes are acceptable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Cabinets: Install without distortion so 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 installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips, No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish, toggle bolts through metal backing or metal framing behind wall finish.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

J. Refer to Division 09 “Painting” Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; 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 shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 4023

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to the following:
1. Sound attenuation insulation.
2. Vapor retarders.
3. Air infiltration barrier (Air Barrier).
4. Note: For roof insulation; refer to Roofing Specification types.

B. Related Sections include the following:
1. Division 06 1600 Section "Sheathing" for foam-plastic board sheathing over wood framing.
2. Division 07 Sections “Roofing” for roofing types on this Project for insulation specified as part of roofing construction.
3. Division 07 8413 Section "Penetration Firestopping" for insulation installed as part of a perimeter fire-resistive joint system.
4. Division 09 Section **Gypsum Board** for installation in metal-framed assemblies of insulation specified by referencing this Section.

1.3 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

a. Manufacturers:

1. DiversiFoam Products.
2. Dow Chemical Company.
3. Owens Corning.
4. Pactiv Building Products Division.
5. Apache Products Co.
6. Johns Manville Corp.
7. Celotex Corp.
8. Thermafiber.
9. Tenneco Building Products.
10. U.S. Gypsum Co.
11. Applegate Insulation Manufacturing, Inc.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
2. Insulation Criteria: Provide insulation at all exterior building walls, even if drawings do not indicate insulation. Provide insulation thickness with minimum R-values indicated.

a. Walls and Vertical locations: R=10 (min.), unless otherwise specified or indicated on drawings.
b. Roofs and Horizontal locations: R=19 (min.) unless otherwise indicated on drawings.

2.3 FOAM-PLASTIC BOARD INSULATION

A. Roofing Insulation Systems:

1. Refer to Division 07 Section "Roofing" for insulation specified in roofing types in this Project.

2.4 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER BLANKET INSULATION

A. Sound Attenuation Abatement Insulation: Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

1. For Fire-Rated Locations: Unfaced mineral fiber batts or blanket insulation complying with ASTM C-665, Type 1 and ASTM C-136 for fire-rated conditions.

B. Exterior Perimeter Enclosure Walls (Metal-framed installation): Faced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.

C. Fire-safing Insulation: Unfaced safing insulation 5" minimum depth held in place with impaling clips or other approved supports for fire-rated separation as indicated on drawing and as required for fire-safing to stay-in-place.

2.5 SPRAY-APPLIED CELLULOSIC INSULATION

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, **Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications),** chemically treated for flame-resistance, processing, and handling characteristics.

2.6 VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less

than 25 lb/1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).

1. Vapor Retarder – Standard (Underslab General Areas): Standard Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, not less than 7.8 mils (0.18 mm) thick; or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

    a. Manufacturers: "Fortifiber or Raven Industries."
    b. Other manufacturers complying to specified requirements, acceptable to the Architect.

2. Vapor Retarder – Heavy-Duty (Underslab at wood flooring and swimming pool deck areas): Heavy-Duty. ASTM E-1745-97 Class C, of non-woven geotextile laminated with polyethylene to a low-perm membrane not less than 15 mils (0.29 mm) thick.

    a. Manufacturers technical criteria; "Fortifiber – Moistop Plus" underslab vapor retarder or "Raven Industries" – Vapor Block-15 or acceptable equal by other manufacturers.
    b. Other manufacturers complying to specified requirements and acceptable to the Architect.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

2.7 AIR INFILTRATION BARRIER (Air Barrier)

A. Manufacturer's Products: Subject to compliance with requirements, products that may be incorporated into the work include, but not limited, to the following:

1. DuPont, Tyvek Homewrap.
2. Tenneco; Amowrap.
3. Carlisle Coatings and Waterproofing.

B. Provide air infiltration barrier at exterior side of exterior building wall sheathing.

2.8 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.9 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place:

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of **1 inch (25 mm)** between face of insulation and substrate to which anchor is attached.

E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs at least 24 inches on-center.

D. Apply self-supported, spray-applied cellulosic insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it flush with face of studs by using method recommended by insulation manufacturer.

E. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.5 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Install **3-inch- (76-mm-)** thick, unfaced slag-wool-fiber/rock-wool-fiber sound attenuation blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches (1219 mm) on either side of partition.

1. Refer to Construction Document Drawings for additional information and locations.

3.8 INSTALLATION OF FIRE-CONTAINMENT SYSTEMS

A. Perimeter Locations: Install perimeter fire-containment systems to fill gap between edge of concrete floor slab and back of spandrel panels of exterior curtain-wall systems to comply with Building codes and other agencies having jurisdiction.

B. Other Fire-Rated Locations: Install fire-containment systems at top of partitions to fill gaps between wall and the deck above.

C. Install fire-sealer on the fire-safing materials at the fire-separation conditions for a vapor-tight and smoke-tight condition.

D. Provide impaling clips or other approved mechanical methods to support and hold the fire-safing material in place.

3.10 INSTALLATION OF VAPOR RETARDERS

B. General: Extend vapor-retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor-retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor-retarders over framing by lapping not less than two wall studs. Fasten vapor-retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (400 mm) o.c.

D. Before installing vapor-retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor-retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

E. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

F. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor-retarder.

G. Repair tears or punctures in vapor-retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor-retarder.

3.11 ACTION

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

END OF SECTION 07 2100

SECTION 07 4113 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Standing-seam metal roof panels.
2. Under-layment materials – ice and water shield.
3. Snow guards.
4. Manufacturers Roofing Representative – on-site inspection.

B. Related Sections:

1. Division 05 3100 Section "Steel Decking" for steel roof deck supporting metal roof panels.
2. Division 05 4000 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal roof panels.
3. Division 07 2100 Section “Thermal Insulation” for roof insulation not a part of the roofing system.
4. Division 07 6200 Section "Sheet Metal Flashing and Trim" for field-formed fasciae, copings, flashings, roof drainage systems, and other sheet metal work not part of metal roof panel assemblies.
5. Division 07 7100 Section "Roof Specialties" for manufactured fasciae, copings, roof drainage systems, and other roof specialties not part of metal roof panel assemblies.
6. Division 07 9200 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weather-tight roofing system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Comply with Building codes and other agency jurisdictional requirements.

B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than **0.06 cfm/sq. ft. (0.3 L/s per sq. m)** of roof area when tested according to ASTM E 1680 at the following test-pressure difference:

1. Test-Pressure Difference: Positive and negative **1.57 lbf/sq. ft. (75 Pa)**.
2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12.0 lbf/sq. ft. (575 Pa).
2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

G. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: FMG Class 1-90.
2. Hail Resistance: MH.

H. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

   a. Uniform pressure of **30 lbf/sq. ft. (1436 Pa)**, acting inward or outward.
   b. Uniform pressure as indicated on Drawings.

2. Snow Loads: **30 lbf/sq. ft. (1436 Pa)**.
3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/180 of the span.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): **120 deg F (67 deg C),** ambient; **180 deg F (100 deg C)**, material surfaces.

J. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

K. Solar Reflectance: Initial solar reflectance of not less than 0.25 when tested according to ASTM E 903, and maintained, under normal conditions, solar reflectance not less than 0.15 for 3 years after installation.

L. Minimum Emissivity Rating: Provide roofing materials with 0.75 or greater emissivity when tested according to ASTM E 408.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and end-lap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

   a. Flashing and trim.
   b. Gutters.
   c. Downspouts.
   d. Roof curbs.
   e. Snow guards.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Roof and Soffit Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, clips, battens, closures, and other metal roof panel accessories.

D. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Snow Retention System Calculations: Include calculation of number and location of snow guards based on snow load, roof slope, panel length and finish, and seam type and spacing.

E. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof panels and attachments.
2. Purlins and rafters.
3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.

F. Qualification Data: For qualified Installer, professional engineer and testing agency.

G. Material Certificates: For thermal insulation and vapor retarders, from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

I. Field quality-control reports by the Contractors and Manufacturer.

J. Maintenance Data: For metal roof panels to include in maintenance manuals.

K. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A company in continuous business at least three (3) years that is approved by the manufacturer that employs trained workers.

B. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

C. Surface-Burning Characteristics: Provide metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

D. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Combustion Characteristics: ASTM E 136.

E. Mockups: Build in-place mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave**,** including fascia, and soffit as shown on Drawings; approximately four panels wide by full eave width, including insulation, under-layment, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative,

deck, purlin and rafter Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
4. Examine deck substrate, purlin and rafter conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of deck, purlins and rafters during and after roofing.
6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for metal roof panel assembly during and after installation.
9. Review roof observation and repair procedures after metal roof panel installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

G. Manufacturer’s Roofing Systems On-Site Field Inspections:

1. Provide Manufacturer’s Roofing Technical Representative to conduct on-site field inspections with the Roofing Contractor at the beginning of roofing installation and at the completion of roof construction.
2. Provide additional On-Site roofing technical service when requested by the Contractor.
3. Submit written reports of all meetings to the Architect within ten (10) calendar days.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weather-tight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

E. Protect foam-plastic insulation as follows:

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

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, purlins and rafters, parapets, walls, and other adjoining work to provide a leak-proof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

C. Special Weather-tightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weather-tight, including leaks, within specified warranty period.

1. Weather-tight Warranty Period: Five (5) years from date of Substantial Completion.

D. Special Weather-tightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weather-tight, including leaks, within specified warranty period.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality. Provide 0.40 inch (1.02 mm) minimum metal thickness.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality. Provide 0.050 inch (1.27 mm) minimum metal thickness
3. Surface: **Smooth, flat** finish.
4. Exposed Coil-Coated Finish:
   a. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required. Provide 0.050 inch (1.27 mm) minimum metal thickness.

1. Surface: **Smooth, flat** finish.
2. Exposed Coil-Coated Finish:
   a. 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   b. 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
   d. Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Refer to Division 07 Section "Thermal Insulation."

B. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

C. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (240 kPa), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed.

D. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 aluminum foil, Type II, Class 1 or 2 felt or glass-fiber mat, Grade 3 or Type V, oriented-strand-board facing with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.

E. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density unless otherwise indicated; with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.

F. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).

G. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.

1. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
2. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).

H. Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202 or ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.

1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:

I. Composition: Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating, Polypropylene faced, scrim reinforced, and foil backing or Vinyl faced, scrim reinforced, and foil backing.

1. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed, galvanized-steel or PVC retainer clips colored to match insulation facing.
2. Thermal Spacer Blocks: Fabricated from extruded polystyrene, 1 inch (25 mm) thick.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by under-layment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
3. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
   b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Felts: ASTM D 226, Type II (No. 30) or Type I (No. 15), asphalt-saturated organic felts.

C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 SUBSTRATE BOARDS (where indicated on Drawings)

A. Gypsum Board: Type X, of thickness indicated, with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges. ASTM C 1396/C 1396M.

B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Type and Thickness: Type X, 5/8 inch (16 mm).
2. Product: Subject to compliance with requirements, provide Dens-Dek by Georgia-Pacific Corporation or equal product acceptable to the Architect.

C. Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

2.5 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: 0.040 inch (1.02 mm), unless otherwise indicated.
2. Depth: 1-1/2 inches (38 mm), unless otherwise indicated.

C. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.

1. Nominal Thickness: As required to meet performance requirements or 0.064 inch (1.63 mm), minimum.

2. Depth: As indicated, 3/4 inch (19 mm).
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.

1. Nominal Thickness: As required to meet performance requirements, 0.025 inch (0.64 mm).

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

2.6 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weather-tight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Architectural Building Components.
b. Architectural Roofing and Siding, Inc.
c. CENTRIA Architectural Systems.
d. Fabral.
e. Metecno-Morin; Division of Metecno Inc.
f. Petersen Aluminum Corporation.

2. Manufacturer's Product: Basis-of-Design:

   a. Manufacturer: Fabral
   b. Style / Design: Snap on seam high profile
   c. Material: 22 gauge steel
   d. Color and Finish: As selected by Architect from manufacturer's full range.

2.8 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
   2. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weather-tight construction.
   3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch (0.45 mm) thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from same material roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels and roof fascia and rake trim.

D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.

E. Roof Curbs: Fabricated from same material as roof panels, minimum **0.048 inch (1.2 mm)** thick; with bottom of skirt profiled to match roof panel profiles, and welded top box and integral full-length cricket. Fabricate curb subframing of minimum 0.0598-inch- (1.5-mm-) thick, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.

   1. Insulate roof curb with minimum 1-inch- (25-mm-) thick, rigid insulation.

F. Nail Base Insulation: ASTM C 1289.95 Class 1, Type V R-value = 18 minimum, based on LTTR values. Provide an integral fabricated plywood board and rigid insulation roof decking unit for metal roofs unless otherwise noted.

G. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method.

2.9 SNOW GUARDS

A. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.

1. Seam-Mounted, Bar-Type Snow Guards: **Aluminum** rods or bars held in place by stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

a. Aluminum Finish: **Clear anodized**
b. Products: Subject to compliance with requirements, provide one of the following:

1) Alpine SnowGuards, Div. of Vermont Slate & Copper Services, Inc.
2) LMCurbs.
3) Metal Roof Innovations, Ltd**.**
4) Riddell & Company, Inc.
5) Snow Management Systems, a division of Contek, Inc.
6) TRA-MAGE, Inc.

2.10 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. End Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.11 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

B. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

C. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

D. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

1. Submit manufacturer’s written roofing report to the Architect within seven (7) days.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Substrate Board: Install substrate boards over roof deck or sheathing on entire roof surface. Attach with substrate-board fasteners.

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
2. Comply with UL or FMG requirements for fire-rated construction.

C. Miscellaneous Framing: Provide and install additional subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Under-layment: Apply primer if required by manufacturer. Comply with temperature restrictions of under-layment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend under-layment into gutter trough. Roll laps with roller. Cover under-layment within 14 days.

1. Roof perimeter for a distance up from eaves of **36 inches (914 mm)** beyond interior wall line.
2. Valleys, from lowest point to highest point, for a distance on each side of **18 inches (460 mm)**. Overlap ends of sheets not less than 6 inches (150 mm).
3. Rake edges for a distance of **18 inches (460 mm)**.
4. Hips and ridges for a distance on each side of **12 inches (300 mm)**.
5. Roof to wall intersections for a distance from wall of **18 inches (460 mm)**.
6. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **18 inches (460 mm)**.
7. Ice and Water Shield Waterproof Under-layment: Apply waterproof under-layment at eaves. Cover deck from eaves to at least 36 inches (900 mm) inside exterior wall line.

    a. In addition to eaves, apply waterproof under-layment in place of felt under-layment at valleys.

B. Felt Under-layment: Apply at locations indicated on Drawings, in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).

1. Apply over entire roof surface.
2. Apply on roof not covered by self-adhering sheet under-layment. Lap over edges of self-adhering sheet under-layment not less than 3 inches (75 mm), in shingle fashion to shed water.

C. Apply slip sheet over under-layment before installing metal roof panels.

D. Install flashings to cover under-layment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.4 METAL ROOF PANEL INSTALLATION, GENERAL

A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.

1. Point of Fixity: Fasten each panel along a single line of fixing located at eave, ridge, center of panel length.
2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.

C. Install metal roof panels as follows:

1. Commence metal roof panel installation and install minimum of **300 sq. ft. (27.8 sq. m.)** in presence of factory-authorized representative.
2. Field cutting of metal panels by torch is not permitted.
3. Install panels perpendicular to purlins.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Provide metal closures at rake edges, rake walls, and each side of ridge and hip caps.
6. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
7. Install ridge and hip caps as metal roof panel work proceeds.
8. End Splices: Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
9. Install metal flashing to allow moisture to run over and off metal roof panels.

D. Fasteners:

1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Roof Panels: Use copper, stainless-steel, or hardware-bronze fasteners.

E. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt under-layment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.5 METAL SOFFIT AND FASCIA PANEL INSTALLATION

A. In addition to complying with requirements in "Metal Roof Panel Installation, General" Article, install metal soffit panels to comply with requirements in this article.

B. Metal Soffit Panels: Provide metal soffit panels and soffit venting panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

C. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weather-tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.7 SNOW GUARD INSTALLATION

A. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam metal roof panels with clamps or set screws. Do not use fasteners that will penetrate metal roof panels.

1. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning up from gutter.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4113

SECTION 07 5356 - DURO-LAST – MECHANICALLY FASTENED ROOFING SYSTEM SINGLE PLY MEMBRANE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to, the following:

1. Mechanically fastened membrane roofing system.
2. Roof insulation.
3. Roof traffic walkways.
4. Manufacturer's Roofing Representative "On-site Inspections."

B. Related Sections include:

1. Division 07 6200 Section "Sheet Metal Flashing and Trim."
2. Division 07 7100 Section "Roof Specialties" for coordination of roof items.
3. Division 07 7200 Section "Roof Accessories" for coordination of roof items.
4. Division 07 9200 Section Joint Sealants."

1.3 PERFORMANCE REQUIREMENTS

A. Contractor shall furnish and install a 40 mil single-ply (minimum thickness) mechanically fastened membrane roofing system that is fabricated of a weft inserted low-shrink, anti-wicking polyester fabric and has a thermoplastic coating of co-polymer alloy (CPA) material laminated to both sides as manufactured by Duro-Last Roofing, Inc.

B. Application: This specially formulated thermoplastic coated membrane classified as CPA in this section consists of a weft inserted polyester scrim (18x14, 100 denier), laminated on both sides with a plasticized blend of vinyl and acrylic polymers which allows installation through the use of continuous 3-1/4 inch securing tabs, factory dielectrically welded every 60 inches on center (prefabricated). Mechanical fasteners and distribution plates are used through the 3-1/4 inch tab eliminating the need for ballast.

C. Physical Properties: The single ply membrane shall allow installation at any time of the year and shall provide: resistance to ultra-violet rays, superb tear and puncture strength, the ability to be impervious to most caustic chemicals and acids, and show no ill effects to heat or cold.

D. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and as follows:

1. Fire/Windstorm Classification: FMG 1-90.
2. Hail Resistance: MH.

3. FMG 1-28 and FMG 1-29 loss prevention criteria for insulation and membrane performance.

E. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist the factored design uplift pressures calculated according to SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems." Minimum Pressures indicated. Provide more as required to comply with FMG requirements.

1. Corner Design Uplift Pressure: 15 lbf/sq. ft. (kPa/sq. m).
2. Perimeter Design Uplift Pressure: 12 lbf/sq. ft. (kPa/sq. m).
3. Field-of-Roof Design Uplift Pressure: 10 lbf/sq. ft. (kPa/sq. m).
4. Fire/Windstorm Classification: Class 1A-90.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Membrane and related items shall be classified by Underwriters Laboratories, Inc. as a Class A Sheathing Material for use in construction of Class A coverings and amendments. Membrane and related items shall be Factory Mutual approved as an assembly.

B. Roofing Contractor's Qualifications:

1. Contractor shall submit work history data showing having had successful warranted installation experience of the system specified, and of being authorized by the roofing system manufacturer to install the specified manufacturer's materials.
2. The contractor shall use qualified workmen who are thoroughly trained in the crafts and techniques required to properly install the type of roofing system proposed for use and other work required to complete the work specified.
3. The contractor shall have an experienced, pre-qualified, thoroughly trained superintendent having experience installing the roof system specified, who is familiar with the requirements of this project, on the job at all times when roofing system work is in progress. Training for superintendent shall include certification of completion of manufacturer's in-house training course and on-site training.

C. Requirements of the Membrane manufacturer:

1. All components of the roofing system shall conform to the current published specifications and details of Duro-Last Roofing, Inc.

2. There shall be no deviation made from this specification without prior written approval of Duro-Last Roofing, Inc. and building owner or their appointed representative.

3. Other manufacturers proposing to supply material for this project shall submit fourteen (14) calendar days prior to bid date, provide financial information regarding their roofing company, i.e. a current D&B report. A manufacturer who has less than $30,000,000.00 in annual roofing material sales, a net worth of less than $2,000,000.00 or a history of late payments to creditors will not be permitted to submit their roofing material for use on this project. Manufacturer may be asked to submit an audited document listing the long-term warranty liability commitment of manufacturer.

4. Provide primary flexible sheet factory prefabricated roofing system from a single manufacturer that has successfully manufactured raw materials into specified products for not less than five (5) years. No secondary private labels are acceptable. Provide secondary materials, such as but limited to insulation, gypsum board, vapor barriers, etc. as recommended and approved by manufacturer of primary materials.

D. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

E. Manufacturer's Roofing Representative On-Site Inspection:

1. The Owner reserves the right to retain, at the Owner's expense, additional independent inspection service to provide full-time inspection of the roofing system installation. The inspector shall have free access to the work area.
2. The contractor shall arrange for Duro-Last Roofing, Inc. Technical Representative to provide inspections of the roofing system installation. The inspection shall be held with Roofing Contractor at the beginning and at the completion of construction. Submit reports of all meetings to the Architect with-in ten (10) calendar days, to ascertain that the all elements of the roofing system have been installed in accordance with the membrane manufacturer's published specifications and details.

F. Defective Work: Should the installation of the roofing system not be approved by Duro-Last Roofing, Inc.'s technician, correcting the defective work shall be done by the contractor until the roofing system satisfactorily meets all the specifications and manufacturer's requirements. Corrective work will be done WITH NO ADDITIONAL EXPENSE TO THE OWNER.

1.5 WARRANTY

A. The contractor shall warrant the roof application with respect to workmanship and proper application for two (2) years from the date of acceptance by the membrane manufacturer. Should any leaks covered under the warranty occur during this period, corrective action will be taken by the contractor to repair the roof to the satisfaction of the owner and Duro-Last Roofing, Inc. ALL CORRECTIVE WORK WILL BE DONE AT NO COST TO THE OWNER.

B. The warranty shall be full roofing system repair and/or replacement covering materials and labor. The warranty shall be a no-dollar limit type and provide for completion of repairs, replacement of membrane or total replacement of the "roofing system" at the then current material and labor prices throughout the life of the warranty. Warranty shall contain no exclusions for ponded water, biological growth, incidental or consequential damages.

1. Warranty: Fifteen (15) years from Owner's acceptance.

C. Warranty shall be issued by the original manufacturer of the roofing membrane. No private

label membranes will be accepted.

D. No work shall be done on said roof, including but without limitations, openings made for flues, vents, drains, sign braces, or other equipment fastened to or set on the roof, unless the Contractor or membrane manufacturer is notified first. Contractor or membrane manufacturer shall be given the opportunity to make the necessary roofing application recommendations with respect thereto, and require such recommendations are complied with.

E. Corrective measures on leaks shall be undertaken within forty-eight (48) hours after notification has been received by the Contractor or Duro-Last Roofing, Inc. from the Owner.

F. Weight Requirements:
The total weight of the installed roofing system including all accessories, i.e: screws, plates, 2-way breather vents, etc., shall not exceed 25 pounds per square.

G. Mechanical Roofing System Attachment:

1. Membrane fastening for buildings with maximum height of 40 feet (12m), securement tabs shall be spaced maximum of 60 inches (1.45m) on center and the first tab on the edge of the sheet parallel to the roof edge shall be a maximum 36 inches (.75m). Fastening for buildings that are greater than 40 feet (12m) consult Duro-Last Roofing, Inc. for proper fastening.
2. Deck membrane shall be fastened with approved fasteners, 18 inches on center along bottom of all parapet walls, elevation changes and perimeter edges.
3. Deck membrane shall be fastened around cut-outs with approved fasteners 12 inches on center or a minimum of 1 per round penetration having a diameter of not more than 6 inches.

1.6 SUBMITTALS

A. Required Submittals to the Architect:

1. Written confirmation from Duro-Last Roofing, Inc. that the installer is an approved applicator.
2. Duro-Last Roofing, Inc.'s product literature on the following items:

   a. Roofing membrane with dielectrically welded seams
   b. Pre-manufactured parapet flashings
   c. Pre-manufactured pipe flashing
   d. Urethane sealant
   e. P.V.C. weldable drip-edge, gravel/water stop, termination bar
   f. Breathable 2-way vents
   g. Self-leveling pourable sealer

   h. Maintenance & repair instructions
   i. Walkway pad
   j. Roofing insulation

3. Shop drawings (copies of these must be sent to Duro-Last Roofing, Inc.).
4. Pullout Tests: Perform pullout tests and submit engineering results of Duro-Last Roofing, Inc.'s random location pull tests. Duro-Last Roofing, Inc. shall obtain at least one pull resistance test from indicated locations on the drawings. Submit pull test results with

drawing indicating the locations of the tests. Engineering results shall demonstrate the Duro-Last Roofing, Inc.'s reasons for selection of anchorage, frequency and the seaming patterns.

5. Membrane Data: Prior to receipt of bids, contractor shall submit all forms and other required data to Duro-Last Roofing, Inc. for pre-approvals. Advise architect in writing of any recommendations made or revisions required by Duro-Last Roofing, Inc. to particular job conditions. In the absence of any comments, the Owner and/or his representative shall assume Duro-Last Roofing, Inc.'s most recently published specifications shall be followed.
6. Samples: Submit samples to the Architect for approval prior to ordering and delivery so as to not delay progress and completion of the work or final inspection.
7. Provide repair procedures to the Owner and/or Owner's representative.

B. Required Submittals:

1. Submit shop drawings for approval. Shop drawings may be required for final inspection of the warranted roof. Shop drawings shall be approved by Duro-Last Roofing, Inc.
2. Shop drawings shall include: outline of the roof and roof size, perimeter and penetration details, special details and section layout, location of factory dielectric and field welds, accessory and material list.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING PROCEDURES

A. Deliver materials in original unopened packaging.

B. Containers labeled with manufacturer's name, brand name, and identification of various items.

C. Store materials in a dry area and protect from inclement weather. Damaged materials shall be replaced at contractor's expense.

D. Do not allow roofing membrane to come in contact or be exposed to any materials that would be detrimental to or cause degradation of the roofing membrane.

1.8 JOB CONDITIONS

A. Environmental Conditions:

1. In making field heat welds, make sure all welding surfaces are clean and free of moisture or foreign items.
2. Weather precautions: Proceed with roofing work when existing and forecasted weather conditions permit work performance in compliance with Duro-Last Roofing, Inc.'s recommendations.
3. Roofing system shall not be applied when the surrounding air, surface temperature, relative humidity or wind velocity is not within the range acceptable under the Duro-Last Roofing, Inc.'s recommendations.

B. Protection:

1. Prior to starting work, protect all work in an approved manner including all paving and faces of building walls. Provide special protection of the face of all building wall areas

where roofing is being installed.

2. Complete the whole roofing section or any portion of the roof in a single day to avoid exposure to rain, dew, or moisture of any kind. If rain threatens during the day or in an emergency, protect the unfinished exposed roofing components and provide temporary water cut-offs around exposed edges and incomplete flashing areas.
3. All hoisting equipment shall bear on solid pad blocking. If on the roof surface, pad shall be large enough to evenly distribute the load to avoid crushing insulation and roof system. Pad shall consist of two separate layers of material to eliminate vibration and movement to directly affect the roofing membrane. Pad shall be of sufficient size to accommodate work tools and weights used around hoisting operations.

   a. Verify with Structural Engineer for location of equipment.

4. Repairs: Clean or repair surfaces damaged or soiled by operations under this contract to the satisfaction of the Owner or Owner's representative without additional cost to the Owner. These would include, but not limited to, windows, doors, floors, walls, stairs, elevators, steps, walks, curbs, lawn areas, or other roofs.

PART 2 - PRODUCT

2.1 ROOF MEMBRANE

A. A special formulated, permanent, thermoplastic alloy, bonded to a high tenacity, low shrinkage weft inserted polyester fabric with resistance to ultraviolet rays, microorganisms and impervious to most caustic.

B. Membrane shall be factory dielectrically welded, prefabricated sheets up to 2,500 square feet or as determined by job condition.

C. The new roofing shall be a prefabricated mechanically fastened installation (if required, FM requirements), single-ply reinforced co-polymer alloy (CPA) membrane, 40 mils thick. Manufacturer's physical specifications and minimum performance criteria shall be in accordance with the following schedule.

MINIMUM PERFORMANCE AND PHYSICAL SPECIFICATION REQUIREMENTS FOR MEMBRANE

Physical Property	Test Method Used	Specification Requirements
Thickness Min.	ASTM D-751	40 mils
Tear Strength, Toung Method 8" x 8" sample	ASTM D-751	130 x 110 lbf (minimum) .
Breaking Strength	ASTM D-751	435 x 350 lbf.
EMMAQUA Exposure	ASTM E938, Desert Sun	>6.9 million Langleys
Elongation	ASTM D-751	35%
Dimensional Stability	ASTM D-1204	<.0.1%
Low Temperature Flexibility	ASTM D-2136, 1/8" mandrel	no cracks, -40 degrees F
Dynamic Impact (Puncturing)	Fed. Std. 1013, Method B	350 lbs.
Water Vapor Transmission	ASTM E96 WVT, Procedure B, Method A	>..25 US Perms, 0.086 g/hr//sqm
Accelerated Weathering	Carbon Arc, 6000 Hours	No cracks, crazing, or blistering
Accelerated weathering	ASTM G-5388, 2000 Hrs.	No cracks, crazing, or blistering

UVB-313 Lamp @ 80 degrees C		
Factory Mutual Research	ASTM E-108	Class 1 I-60 & I-90
Underwriter's Laboratory	UL-790	Class A, B, or C
Scrim: Weft Inserted Polyester		18 x 14, 1000 denier

2.2 MANUFACTURER

A. The following manufacturer has been approved for this project:

1. Manufacturer – Basis of Design:

Duro-Last Roofing, Inc.
525 Morley Drive
Saginaw, MI 48601
(800) 248-0280

B. Other Manufacturers requesting approval must submit acceptable information certifying that they are the direct manufacturer from raw material into specified membrane, factory prefabricate the membrane into roofing panels, and meet the performances specified.

1. Substitutions from Other Manufacturers shall be submitted on Architect's form in Division 01 6000 Section "Product Requirements."

C. Fire resistance of CPA roofing system shall meet UL Class A. All packaging of membrane and insulation shall bear UL Class A label.

D. Membrane Color: Architect selected from manufacturer's full range of samples.

2.3 MATERIALS

A. Membrane-Related Materials:

1. All membrane components, including pipe and curb flashings must be factory prefabricated from the same fabric reinforced material used for the deck membrane.
2. Termination Sealant: Compatible with materials to which membrane is to be bonded, conforming to Federal Specifications TT-598 and TT-S-00230C as furnished by Duro-Last Roofing, Inc.
3. Distribution Plates: Factory Mutual approved stress distribution plates formed from a minimum 24 gauge G-90 C.Q. steel with a galvalume coating for insulation attachment, or 20 gauge G-90-C.Q. steel with galvalume coating or high strength polyblend for membrane attachment.
4. Water Cut-Off Mastic: Compatible with materials with which it is used and furnished by the membrane manufacturer.
5. Pitch Pocket Sealant: Shall be a single component, self-leveling silicone sealant furnished by Duro-Last Roofing, Inc.
6. Fasteners: Compatible with roof deck as furnished by the membrane manufacturer. Fasteners shall be furnished by Duro-Last Roofing, Inc. and be Duro-Guard coated #14 and must pass 30 cycles in the Kesternich Cabinet, DIN #50018-2 Liter. The FM approved fastener is inserted through the hole in the distribution plate and properly secured to the roof deck.

7. Breather Vents: Two-way vents with factory-attached skirt shall be installed at a density of one per 1000 square feet of roof deck area and in accordance with Duro-Last Roofing, Inc.'s specifications. Vents shall be furnished by Duro-Last Roofing, Inc.
8. Terminations/Edge Details: Shall be manufactured from rigid exterior vinyl with slotted holes for securement and furnished by membrane manufacturer. All other terminations/edge details must be approved and warranted by Duro-Last Roofing, Inc.

B. Roof Deck Insulation: Polyisocyanurate-Foamboard Insulation. Minimum 25 psi density.

1. ASTM C 1289, Type 1, Class 2, with maximum flame-spread and smoke-developed indicies of 75 and 450, respectively, based on tests performed on unfaced core on thicknesses up to 4 inches.
2. Provide and install board insulation in two (2)- 2" layers.
    a. Mechanically attach first insulation layer directly to roof deck or through the substrate board (if detailed on Drawings).
    b. Adhesively adhere the second layer to the first layer, staggering joint locations of insulation of the second layer.
    c. Roofing Insulation R-value: Provide total insulation thickness to meet R=20, minimum.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of minimum ¼ inch per 12 inches (1:48) upwards from roof drains.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where required and indicated for sloping to drain. Fabricate to slopes indicated.

E. Nailers & Blocking:

1. Where required, nailers and wood blocking shall be S4S 1500 fc construction grade Douglas fir conforming to standard 15 grading and dressing rules of the West Coast Lumber Inspection Bureau, or other species of wood of equal strength. All lumber shall be grade marked at the mill.
2. All lumber shall be pressure treated by a method approved by the roofing membrane manufacturer: "Wolmanized" or "Osmose K-33" are acceptable, or fire-treated where required by authorities having jurisdiction.
3. Nailers shall be securely anchored to the deck to resist the minimum force required in Loss Prevention Data Sheet I-49, "Perimeter Flashing," Factory Mutual Systems, June, 1985. The thickness of the nailer shall be such that the top of the nailer is flush with the surface to which the membrane is to be applied.

F. Accessories: Primary accessories shall be factory prefabricated or manufactured by or under the direction of Duro-Last Roofing, Inc. All other shall be furnished and approved by the Duro-Last Roofing, Inc.

G. Insulation Cover Boards:

1. Cover Board: Duro-Fold 3/8" thick fanfold extruded polystyrene underlayment.

H. Optional Adhesive Attachment Method for Roof Insulation:

1. Provide "Dow Building & Construction; Insta-stik Commercial Roofing Adhesive" to adhere rigid insulation to roof deck or to other substrates.
2. Comply with Manufacturer's written instructions for installation of roofing insulation for the Project's roofing type.

2.4 VAPOR RETARDER AND AIR BARRIER (Provide as specified and where indicated on Drawings)

A. Provide and install Vapor Retarders on roof decks where humidity is prevalent.

1. Locations: Swimming Pools, Saunas, Spas and other areas indicated.
2. Vapor Retarders must have a premeance rating below 0.5 and close to zero as possible.

a. Manufacturer's Product: " Griffolyn, fire-retardant type TX-1200 FR " or approved equal, maximum flame-spread of 10 and smoked-developed of 45 per ASTM E-84.

2.5 ROOF TRAFFIC WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

1. Size: 30" x 60" membrane, unless otherwise indicated.
2. Quantity: Provide 120, 30" x 60" walkway pads and install on new roof as directed by Owner/Construction Manager.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Substrate Inspection:

1. Inspect all surfaces to receive roofing for any condition that will adversely affect execution, performance, or quality of work.
2. All roof surfaces and all sloped surfaces to drains and outlets shall be checked and approved by the roofing contractor prior to the start of the roofing work.
3. Install roofing material only under satisfactory conditions as specified by Duro-Last Roofing, Inc.
4. Scheduling: Schedule the roofing work in areas and sections in such a manner as to keep the new and existing insulation, roofing materials, and building absolutely dry and watertight during new roofing work.
5. Any damage sustained to the building or contents as a result of improper scheduling of roofing work shall be the contractor's responsibility.

B. Surface Preparation:
Contractor's proposal shall include all costs for the removal of wet or damaged existing roofing insulation and replacement as required, repair of blisters, existing flashings, expansion and control joint covers, and repair or replacement of required treated wood nailers or blocking.

1. The total extent of preparation shall include the above and comply with the Duro-Last Roofing, Inc.'s recommendations.
2. Mechanically secure separation material units to roofing deck independent of membrane attachment and cover immediately with membrane. Butt units tightly together, limiting joint separation to 1/8 inch, maximum. Meet attachment pattern requirements of Duro-Last Roofing, Inc.

3.2 GENERAL REQUIREMENTS

A. Precautions:

1. Do not lay out or expose any insulation on the deck that cannot be covered by membrane on the same day.
2. In making all field heat welds, make sure all edges are clean and free of tar, mastic or other foreign items.
3. Do not expose membrane and accessories to a constant temperature in excess of 110 degrees Fahrenheit.
4. Sealants and adhesives should be applied according to the manufacturer's specifications and all containers shall be disposed of properly.
5. Start securing the membrane at the highest point and work towards the drains.

B. Protection of Roofing Surfaces: Storing, wheeling, or trucking directly on roof insulation or membrane surface is not recommended. Smooth, clean plywood or plank walkways, runways and platforms shall be provided as necessary.

3.3 INSULATION INSTALLATION

A. General: The roof insulation shall be installed with approved fasteners and distribution plates placed according to specification. Insulation board having maximum of dimensions of 2 x 4 feet shall require a minimum of 2 fasteners. Insulation boards having maximum of dimensions of 4 x 4 feet shall require a minimum of 4 fasteners. Insulation boards having maximum of dimensions of 4 x 8 feet shall require a minimum of 6 fasteners. Install the fasteners flush with the top surface of the insulation board. The ends of the insulation boards shall be staggered 50% from row to row. Butt each insulation board firmly to the adjacent board. Do not jam insulation boards or allow cracks between insulation boards. Cut boards to allow a maximum 1/4 inch gap away from vertical surfaces. The following FM approved insulation's are approved for use with the membrane cover, fiberglass, urethane/OSB composite, polyisocyanurate or others approved by Duro-Last Roofing, Inc. Contact Duro-Last Roofing, Inc. for specific applications.

3.4 MEMBRANE INSTALLATION

A. Laying Out: Select the proper factory marked rolled sheet of roofing membrane for an outside corner or high point. Orient the roofing membrane so that the 3 inch wide fastening tabs are perpendicular to the ribs or corrugations of a steel deck or perpendicular to the width of the prestressed concrete "T" slabs, etc. When laying out each tab, pull the membrane tight.

B. Roof Sections: Unfold first sheet along edge of roof or parapet wall. Position and fasten first tab with plates and screws according to membrane manufacturer specifications. Unfold roofing sheet to the second 3-1/4 inch wide fastening tab. Pull tab tight and secure to deck as herein described, maintaining proper plate and screw frequency, squarely placed. Continue unfolding and fastening roofing membrane until entire sheet is in place. Install the adjacent roofing membrane sheets using the fastening procedure described. Proceed until all sheets are in place, thus forming a monolithic roof cover. Make sure all edges of each sheet of roofing are fastened with the same fastener spacing as tabs or are welded to another sheet that is fastened in this manner.

C. Field Welding: All field heat seams of the roofing materials shall be 1-1/2 inch wide minimum and be made with a hot air welder. The hot air welder shall be in such a position so that the outside edge and both pieces of material will receive an equal amount of heat and all of which will be closely followed by a 1-5/8 inch wide roller specially designed for this purpose.

D. Perimeter Nailing: The membrane shall be mechanically fastened at all roof perimeters, parapets, curbs, wall, penetrations, etc. in strict accordance with the Contract Documents and Duro-Last Roofing, Inc.'s specifications and details.

E. Cut-Outs: Make cut-outs in roofing membrane for protrusions through the roof. Some situations might require that the deck membrane be slit to the section edge for fitting around protrusions. Fasten around cut-outs with approved fasteners, 12 inches on center or a minimum of one per side. The skirts on factory prefabricated accessories when welded to deck will cover these.

F. Stacks: After membrane has been attached, select proper size of premanufacturered round stack for roof vents and pipes. Drop stack flashing over the pipe, lay flat to the roof, and heat weld the skirt to the deck membrane. Using appropriate hand tool, tighten stainless steel band (or stainless steel screw clamp) around top of stack flashing to prevent water penetration, and cut off excess. Using factory approved sealant, liberally seal the top of the stack flashing and steel band.

G. Custom Curbs/Pitch Pockets: After securing cut-out as stated, heat weld the bottom of the skirt to the deck membrane. If the square or rectangle penetration has a removable top, i.e. roof hatch, skylight, etc., remove the unit and fold the custom curb flashing over the top, secure, then replace unit. If top is not removable, secure the top of the custom curb flashing with termination bar and seal with factory approved sealant. Use this same procedure on existing or new pitch pockets.

H. Breather Vents: Install a two-way breather vent for every 1,000 square feet of deck area. Factory prefabricated vents with a skirt made from roofing membrane shall be used. For new construction or reroof after tear-off, a 2-1/2 inch diameter hole cut down through the roofing membrane and insulation facer is required. For recover/non-tear-off application a 2-1/2 inch diameter hole is to be cut through the roofing membrane and the facer down to the facer on the existing insulation. Heat weld skirt to the deck membrane so as to position two-way vent directly over the hole. Careful placement of the breather vents must be observed. DO NOT locate in valleys, next to roof penetrations, scuppers, roof drains, etc. Equally space the vents throughout the roof area. Do not fasten the vent or the skirt to the roof deck. This two-way breather vent is designed to vent the roofing system only and not the building to which it is installed.

I. Parapet Walls: Fasten bottom tab of prefabricated parapet wall flashing 12 inches on center with approved fasteners. This fastening sequence will secure both bottom of parapet and edge of deck membrane. Base skirt should extend approximately 6 inches onto the roof. This allows for a 1-1/2 inch wide weld and covering of the fasteners and plates. Heat weld skirt to deck membrane. On all termination bar applications, start fastening at one end and proceed to the other. This will eliminate buckling of the termination bar. Seal behind the parapet wall material and on top of termination bar with factory approved sealant. If parapet wall coping is to be covered, extend covering down 2 inches on exterior face of coping and terminate accordingly.

J. Scuppers: Use of prefabricated custom roof scuppers is required. Terminate outside of scupper lining with termination bar as specified and field weld inside skirting to membrane.

Apply sealant to underside of lining and top of termination bar.

K. Gutter Edge:

1. If gutter is attached to building 2 inches or more below roof line, extend deck membrane over edge and terminate with termination bar and fasten 6 inches on center. Apply sealant as specified.
2. When the gutter is attached to the building level wit the roof line, notch the drip edge face around the gutter support brackets and install according to specifications.

L. Roof Drains:

1. Secure cut-out made in deck membrane with four (4) equally spaced fasteners and distribution plates. If drain is flush with deck, use a prefabricated drain boot. Apply factory-approved sealant all around drain approximately 12 inches under deck membrane and install the expanding snap rings.
2. If the roof drain has a secure clamping ring and strainer, unbolt and remove. Clean and apply factory-approved sealant under deck membrane around drain for use as a water block seal after cutting properly sized hole. Secure clamping ring and strainer to drain base over deck membrane. Seal with factory approved sealant between clamping ring and roofing membrane.

M. Expansion Joints/Valleys:

1. Whenever encompassing an elevated mid-roof expansion joint, must use a prefabricated expansion joint section. This section shall allow loose layment over the joint and approved fastening on either side. A 6 inch skirt on both sides will provide coverage of fasteners and still allow approximately 1-1/2 inch for a heat weld to deck membrane.

2. Valleys are worked in the same manner. Fasten according to specifications, 12 inches on center, and lap deck membrane over fasteners. Heat-weld deck membrane to valley section.

N. Roof Tie-Ins:

1. When terminating the roofing membrane onto an existing roof, care must be taken to stop any water from backing under the new deck membrane.
2. For tie-ins on flat roofs, i.e. wood, concrete, gypsum, Tectum, etc., cut a 2 inch slot to substrate or vapor barrier. Apply sealant and terminate using termination bar secured 6 inches on center with approved fasteners. Fill slots with urethane foam sealant, level with roofline.
3. When the tie-in is perpendicular to the flutes of a steel deck, they must be filled level. Terminate according to above instructions.
4. On tie-ins into shingled pitch roof, secure on flat deck according to specifications 12 inches on center and fold membrane over fasteners and up under shingles. Apply approved sealant for water stop under membrane and terminate 3 inches on center with fasteners at a vertical height of no less than 12 inches.

3.5 CLEAN-UP

A. Upon completion of the membrane installation, the contractor shall remove all foreign matter, rubbish and scrap material from the roof. The membrane surface shall be cleaned using cleaners recommended by the membrane manufacturer.

3.6 INSPECTION & WARRANTY

A. Inspection: Duro-Last Roofing, Inc.'s Quality Assurance Inspector, and Roofing Contractor shall conduct all required inspections. Submit all required drawings, details, and completed questionnaires to the roofing manufacturer before obtaining the specified warranty. After an authorized Quality Assurance Technician has inspected the roof for determining acceptability for warranty issuance, any deficiencies on the final inspection report shall be corrected by the contractor/applicator and made ready for reinspection within five (5) working days.

B. Warranty: Upon receipt of required materials, certifying inspection, and acceptance of the roofing system by Duro-Last Roofing, Inc., the warranty shall be duly executed and issued to the Owner.

3.7 REPAIRS

A. Future repairs or additions to the roofing system shall be made using the heat welding process. Adhesive bonded or butyl tape repairs shall not be allowed for the life of the roof. Provide repair procedures to the Owner and/or Owner's representative.

3.8 CONSTRUCTION DAMAGE

A. Upon completion of work, repair or replace as required, all building materials damaged as a result of the roofing operations. Match existing materials as close as possible. Owner and/or Owner's representative will be involved in the selection of matching materials.

END OF SECTION 07 5350

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manufactured Products:

a. Manufactured through-wall flashing and counter-flashing.
b. Manufactured reglets and counter-flashing.

B. Related Sections:

1. Division 06 1000 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Sections "Roofing Type" for installing sheet metal flashing and trim integral with roofing.
3. Division 07 4213 Section "Metal Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
4. Division 07 7100 Section "Roof Specialties" for coordination of roof items.
5. Division 07 7200 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
6. Division 07 9500 Section "Expansion Control" for manufactured sheet metal expansion-joint assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

1. Exposed Metal Drip Edges: All drip edges shall comply with the following: Hemmed exposed edges, laps utilizing non-skinning butyl sealant, and a compatible sealant where the underside of the hem transitions to the substrate below.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 1: For velocity pressures of 10 to 20 lbf/sq. ft. (0.48 to 0.96 kPa): 40-lbf/sq. ft. (1.92-kPa) perimeter uplift force, 60-lbf/sq. ft. (2.87-kPa) corner uplift force, and 20-lbf/sq. ft. (0.96-kPa) outward force.
2. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa): 60-lbf/sq. ft. (2.87-kPa) perimeter uplift force, 90-lbf/sq. ft. (4.31-kPa) corner uplift force, and 30-lbf/sq. ft. (1.44-kPa) outward force.

3. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa): 90-lbf/sq. ft. (4.31-kPa) perimeter uplift force, 120-lbf/sq. ft. (5.74-kPa) corner uplift force, and 45-lbf/sq. ft. (2.15-kPa) outward force.
4. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208-lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104-lbf/sq. ft. (4.98-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): **120 deg F (67 deg C), ambient; 180 deg F (100 deg C),** material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop in continuous business at least five (5) years that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
3. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
4. Exposed Coil-Coated Finish:
    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. Color: As selected by Architect from manufacturer's full range.
6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
    b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
    c. Henry Company; Blueskin PE200 HT.

d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

D. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Material shall be same as type of flashing and trim.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide or silicone] polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond. Manufacture through-wall flashing with snap-lock receiver on exterior face to receive counter-flashing or interlocking counter-flashing on exterior face, of same metal as reglet.

1. Copper: **16 oz. (0.55 mm) minimum thickness**, unless otherwise indicated in other parts of the Specifications.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Cheney Flashing Company; Cheney Flashing (Dovetail).
2) Cheney Flashing Company; Cheney Flashing (Sawtooth).
3) Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
4) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
5) Sandell Manufacturing Company, Inc.; Pre-Formed Metal Flashing.

B. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counter-flashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions or with interlocking counter-flashing on exterior face, of same metal as reglet.

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. Cheney Flashing Company.
b. Fry Reglet Corporation.
c. Heckmann Building Products Inc.
d. Hickman, W. P. Company.
e. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
f. Keystone Flashing Company, Inc.
g. Sandell Manufacturing Company, Inc.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

F. Seams for Metals: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Galvanized Steel: **0.028 inch (0.71 mm)** thick.
   2. Aluminum-Zinc Alloy-Coated Steel: **0.028 inch (0.71 mm)** thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:
   1. Galvanized Steel: **0.040 inch (1.02 mm)** thick.
   2. Aluminum-Zinc Alloy-Coated Steel: **0.040 inch (1.02 mm)** thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 UNDERLAYMENT INSTALLATION

A. General: Install under-layment as indicated on Drawings.

B. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).

C. Felt Under-layment: Install felt under-layment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

D. Self-Adhering Sheet Under-layment: Install self-adhering sheet under-layment, wrinkle free. Apply primer if required by under-layment manufacturer. Comply with temperature restrictions of under-layment manufacturer for installation; use primer rather than nails for installing under-layment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover under-layment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where required.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Under-layment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt under-layment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.
2. Pre-tinning is not required for zinc-tin alloy-coated stainless steel and zinc-tin alloy-coated copper.
3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning

and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

5. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered **3-inch (75-mm)**] centers.

C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at **16-inch (400-mm)** centers.

D. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at **24-inch (600-mm)** centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at **24-inch (600-mm)** centers.

E. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at **24-inch (600-mm)** centers.
2. Anchor interior leg of coping with screw fasteners and washers at **24-inch (600-mm)** centers.

F. Pipe or Post Counter-flashing: Install counter-flashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

G. Counter-flashing: Coordinate installation of counter-flashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counter-flashing 4 inches (100 mm) over base flashing. Lap counter-flashing joints a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant, interlocking folded seam or blind rivets and sealant, anchor and washer at 36-inch (900-mm) centers.

H. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry or Stone Masonry."

C. Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete."

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials and excess solder. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following manufactured roof specialties:

1. Copings - Parapets and Gravel Stops.
2. Roof edge flashings.
3. Shop-fabricated custom-built copings.

B. Related Sections include the following:
1. Division 06 1000 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 6200 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Division 07 7200 Section “Roof Accessories” for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Division 07 9200 Section “Joint Sealants” for field applied sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Manufacturer and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. FMG Listing: Manufacture and install copings and roof edge flashings that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1-90. Identify materials with FMG markings.

C. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:

1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
2. Details for expansion and contraction.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.6 COORDINATION

A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leak-proof, secure, and noncorrosive installation.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Architectural Products Co.
2. ATAS International, Inc.
3. Cheney Flashing Company.

4. Hickman: W.P. Hickman Co.
5. Metal-Era, Inc.
6. MM Systems Corp.
7. Southern Aluminum Flashing Co.
8. Savanah.
9. Manufacturers/Fabricators of Custom-built Roof Parapet and Copings.

2.2 EXPOSED METALS

A. Prepainted, Zinc-Coated Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation, structural quality, and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: **Smooth, flat** finish.
2. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604 or AAMA 2605, except as modified below:
        1) Color and Gloss: Architect selected from manufacturer’s full range.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer’s standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with paint manufacturer’s written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
1. Color and Gloss: Architect selected from manufacturer’s full range of colors and finishes.

2.3 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

H. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

I. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.5 ROOF COPINGS - PARAPETS/GRAVEL STOPS

A. General Requirements: Provide copings in shapes and sizes indicated, with shop-fabricated corners. Include anchor plates formed from at least 0.028-inch- (0.7-mm-) thick, galvanized steel sheet; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, with no exposed fasteners.

1. Custom-built Manufacturers/Fabricators of Roof Copings – Contractor's Option:

   a. Manufacturers/Fabricators of Custom-built Shop-Fabricated copings and gravel stops shall have been in continuous business for at least three (3) years.
   b. Provide and fabricate custom-built copings and gravel stops complying with details shall be a complete water-tight assembly without exposed fasteners.
   c. Coordinate fabricated items to be compatible and sized to fit with adjacent construction materials.
   d. Provide materials in colors and finishes for selection as directed by the Architect.

2. Provide exposed coping components fabricated from the following metal:

   a. Extruded aluminum in thickness indicated, but not less than 0.060 inch (1.5 mm).
   b. Formed-aluminum sheet in thickness indicated, but not less than 0.050 inch (1.3 mm) thick.
   c. Coil-coated galvanized steel sheet in thickness indicated, but not less than 0.034 inch (0.85 mm) thick.

2.6 ROOF EDGE FLASHINGS

A. Canted Roof Edge Fascia: Manufactured, two-piece, roof edge fascia consisting of **snap-on** or **compression-clamped** metal fascia cover in section lengths not exceeding **12 feet (3.6 m)** and a continuous formed galvanized steel sheet cant dam, 0.028 inch (0.7 mm) thick, minimum, with integral drip edge cleat. Provide matching mitered and welded corner units.

B. Roof Edge Fascia: Manufactured, two-piece, roof edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding **12 feet (3.6 m)** and a continuous formed- or extruded-aluminum anchor bar with integral drip edge cleat to engage fascia cover. Provide matching mitered and welded corner units.

C. Gravel Stops: Manufactured, one-piece, formed-metal gravel stop in section lengths not exceeding **12 feet (3.6 m)**, with a horizontal flange and vertical leg fascia terminating in a drip edge, continuous hold-down cleat, and concealed splice plates of same material, finish, and shape as gravel stop. Provide mitered and welded or soldered corner units.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.

1. Install manufactured roof specialties with provisions for thermal and structural movement.
2. Torch cutting of manufactured roof specialties is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum or stainless-steel manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Under-layment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt under-layment and cover with a slip sheet, or install a course of polyethylene under-layment.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet (3.6 m) with no unplanned joints within 18 inches (450 mm) of corners or intersections.

F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

G. Seal joints with elastomeric or butyl sealant as required by manufacturer of roofing specialties.

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to resist uplift and outward forces according to performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at **30-inch (760-mm)** centers, manufacturer's recommended spacing.
2. Interlock face leg drip edge into continuous cleat anchored to substrate at **24-inch (600-mm)** centers manufacturer's recommended spacing . Anchor back leg of coping with screw fasteners and elastomeric washers at **24-inch (600-mm)** centers, manufacturer's recommended spacing.

3.4 ROOF EDGE FLASHING INSTALLATION

A. Install cleats, cant dams, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings to resist uplift and outward forces according to performance requirements.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7100

SECTION 07 8413 - PENETRATION FIRESTOPPING (FIRESTOPPING AND SMOKE STOPPING SYSTEMS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Fires-topping Assemblies for:

1. Floors and Roofs.
2. Fire-stopping and Smoke-stopping systems.
3. Walls and partitions.
4. Smoke barrier partitions.
5. Perimeter building walls (exterior and interior)
6. Penetration Fire-stop System Schedule.

C. Related Sections include, but not limited to the following:
1. Division 21 Sections “Mechanical” specifying fire-suppression piping penetrations.
2. Division 22 and 23 Sections “Mechanical” specifying duct and piping penetrations.
3. Division 26, 27, and 28 Sections “Electrical” specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration fire-stop systems with the following ratings determined per ASTM E 814 or UL 1479:

1. F-Rated Systems (fire-stop system withstood the fire test for the rating period): Provide through-penetration fire-stop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems (heat transmitted through the fire-stop system during the rating period did not raise temperature): For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect

penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems (amount of air-leakage through the fire-stop system): Where through-penetration fire-stop systems are indicated in smoke barriers, provide through-penetration fire-stop systems with L-ratings indicated of not more than **3.0 cfm/sq. ft (0.01524cu. m/s x sq. m)** at both ambient temperatures and 400 deg F (204 deg C).

C. For through-penetration fire-stop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration fire-stop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide fire-stop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration fire-stop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

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

B. Shop Drawings: For each through-penetration fire-stop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include fire-stop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration fire-stop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration fire-stop condition, submit illustration, with modifications marked, approved by through-penetration fire-stop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Product Certificates: For through-penetration fire-stop system products, signed by product manufacturer.

D. Product Test Reports: From a qualified testing agency indicating through-penetration fire-stop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm in continuous business at least three (3) years experienced in installing through-penetration fire-stop systems similar in material, design, and extent to that

indicated for this Project, whose work has resulted in construction with a record of successful performance.

1. Installer shall be approved by the product manufacturer to install product.

B. Installation Responsibility: Assign installation of through-penetration fire-stop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain through-penetration fire-stop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide through-penetration fire-stop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-stopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for fire-stop systems acceptable to authorities having jurisdiction.
2. Through-penetration fire-stop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration fire-stop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials for through-penetration fire-stop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration fire-stop systems when ambient or substrate temperatures are outside limits permitted by through-penetration fire-stop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration fire-stop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration fire-stop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire-stop systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer's Products: Subject to compliance with requirements, provide one of the through-penetration fire-stop systems indicated for each application that are produced by one of the following manufacturers:

1. A/D Fire Protection Systems Inc.
2. Grace, W. R. & Co. - Conn.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Fire-stop Products.
6. DAP.
7. RectorSeal Corporation (The).
8. Specified Technologies Inc.
9. 3M; Fire Protection Products Division.
10. Tremco; Sealant/Weatherproofing Division.
11. USG Corporation.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration fire-stop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration fire-stop systems, under conditions of service and application, as demonstrated by through-penetration fire-stop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration fire-stop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration fire-stop system manufacturer and approved by qualified testing and inspecting agency for fire-stop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
    a. Slag-/rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration fire-stop systems containing the types of fill materials indicated in the Through-Penetration Fire-stop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Fire-stop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Fire-stop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with fire-stop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration fire-stop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration fire-stop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-stop system materials. Remove tape as soon as possible without disturbing fire-stop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration fire-stop systems to comply with Part 1 "Performance Requirements" Article and with fire-stop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for fire-stop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify through-penetration fire-stop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the fire-stop systems so that labels will be visible to anyone seeking to remove penetrating items or fire-stop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Fire-stop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration fire-stop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration fire-stop system manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration fire-stop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration fire-stop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration fires-top systems immediately and install new materials to produce systems complying with specified requirements.

3.6 GENERAL - PENETRATION FIRESTOPPING

A. Compatibility: Provide through-penetration Fire-stop and Sealer Systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration Fire-stop and Sealer Systems, under conditions of service and application, as demonstrated by through-penetration Fire-stop System Manufacturer based on testing and field experience. Provide and install compatible Sealers.

B. Accessories: Provide components for each through-penetration Fire-stop System that are needed to install fill materials and to comply with “Performance Requirements” Article. Use only components specified by through-penetration Fire-stop System Manufacturer and approved by the qualified testing and inspecting agency for Fire-stop Systems indicated. Accessories include, but are not limited to, the following systems:

3.8 FIRE-STOPPING SYSTEMS SCHEDULE

Note: The UL Design Numbers are noted for reference only; other UL Design Systems may be installed to suit required fire-ratings.

a. Fire-stopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches (100 mm) or less: Any specified acceptable material manufacturers meeting requirements.

1) Concrete Floor and Concrete Block Walls: UL Design No. C-AJ-1000 Series.

a) One (1) hour rating: UL Design No. C-AJ-1013.
b) Two (2) hour rating: UL Design No. C-AJ-1014.

2) Gypsum Corridor and Separation Walls: UL Design No. W-L-1000 Series.

a) One (1) hour rating: UL Design No. W-L-1039.
b) Two (2) hour rating: UL Design No. W-L-1040.

b. Fire-stopping at Combustible Pipe and Conduit Penetrations, of diameter 4 inches (100 mm) or less: Any specified acceptable material manufacturers meeting requirements.

1) Concrete Floor and Concrete Block Walls: UL Design No. C-AJ-2000 Series.

a) One (1) or two (2) hour rating: UL Design No. UL Design No. C-AJ-2082.

2) Gypsum Corridor and Separation Walls: UL Design No. W-L-2000 Series.

a) One (1) hour rating: UL Design No. UL Design No. W-L-2036.
b) Two (2) hour rating: UL Design No. UL Design No. W-L-2060.

c. Fire-stopping at Cable Penetrations, not in Conduit or Cable Tray: Any specified acceptable material manufacturers meeting requirements.

1) Concrete Floors and Concrete Block Walls: UL Design No. C-AJ-3000 Series.

a) One (1) and two (2) hour rating: UL Design No. C-AJ-3022.

2) Gypsum Corridor and Separation Walls: UL Design No. W-L-3000 Series.

a) One (1) hour rating: UL Design No. W-L-3046.
b) Two (2) hour rating: UL Design No. W-L-3048.

d. Fire-stopping at Control Joints (without Penetrations): Any specified acceptable material manufacturers meeting requirements.

1) Between top of fire rated walls and bottom of slab above: UL Design No. HWD0000 Series and HWD1000 Series.
2) Manufacturers: Flexible and sprayable seal; 3M Firedam Spray by 3M or AS105 for Perimeter Joints by Specified Technologies.
3) USG Fire-stop System Thermafiber Fire-safing: 8 lbs. density mineral wool.

e. Temporary Fire-stopping: Intumescent pillows; UL Design No. CAJ4000 Series or WL4000 Series, F Rating 1-1/2 hour.

f. Fire-stopping at head-of-wall gypsum board metal stud partition to fluted metal deck: UL Design No. HW-D-0000 Series.

1) One (1) hour rating: UL Design No. HW-D-0001.
2) Two (2) hour rating: UL Design No. HW-D-0002.

g. Fire-stopping at head-of-wall concrete block (CMU) wall partition to fluted metal deck: UL Design No. HW-D-0009 Series.

1) One (1) or two (2) hour rating: UL Design No. HW-0009.

3.9 PENETRATION FIRESTOP SYSTEM UL-CLASSIFIED REFERENCES

A. Where UL-classified systems are indicated, they refer to the alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Fire-stop Systems for Metallic Pipes, Conduit, or Tubing FS-1: Comply with:

1. UL-Classified Systems: C-AJ-1001-1999.

C. Fire-stop Systems for Metallic Pipes, Conduit, or Tubing FS-2: Comply with:

1. UL-Classified Systems: W-L-1001-1999.

D. Fire-stop Systems for Nonmetallic Pipe, Conduit, or Tubing FS-3: Comply with:

1. UL-Classified Systems: C-AJ-2001-2999.

E. Fire-stop Systems for Electrical Cables FS-4: Comply with:

1. UL-Classified Systems: C-AJ-3001-3999.

F. Fire-stop Systems for Insulated Pipes FS-5: Comply with:

1. UL-Classified Systems: C-AJ-5001-5999.

G. Fire-stop Systems for Insulated Pipes FS-6: Comply with:

1. UL-Classified Systems: W-L-5001-5999.

H. Fire-stop Systems for Miscellaneous Mechanical Penetrations FS-7: Comply with:

1. UL-Classified Systems: C-AJ-7001-7999.

END OF SECTION 07 8413

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following applications:

1. Exterior joints in, but not limited to the following vertical surfaces and horizontal non-traffic surfaces:
    a. Construction joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Perimeter joints between frames of doors, windows, and louvers.
    d. Control and expansion joints in ceilings and other overhead surfaces.
2. Exterior joints in but not limited to the following horizontal Pedestrian and Vehicular traffic surfaces:
    a. Isolation and contraction joints in cast-in-place concrete slabs.
3. Interior joints in, but not limited to the following vertical surfaces and horizontal non-traffic surfaces:
    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings.
    c. Tile control and expansion joints.
    d. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls, and partitions.
    e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    g. All joints between dissimilar materials.
4. Interior joints in but not limited to the following horizontal traffic surfaces:
    a. Isolation joints in cast-in-place concrete slabs.
    b. Control and expansion joints in tile flooring.

B. Related Sections include the following:

1. Division 03 3000 Section “Cast-in-Place Concrete” for joints in concrete.
2. Division 04 2000 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
3. Division 07 8413 Section "Penetration Fireproofing” for sealing joints in fire-resistance-rated construction.
4. Division 08 8000 Section "Glazing" for glazing sealants.
5. Division 09 2900 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
6. Division 09 3000 Section "Tiling" for sealing ceramic type tile joints.

7. Division 095123 Section "Acoustical Tile Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer in continuous business at least three (3) years who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below **40 deg F (5 deg C)**.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer’s Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

1. Manufacturer’s sealant products are indicated for Manufacturer’s “Basis of Design” only. Other manufacturer’s products complying to specified criteria comparable to the Basis of Design Product will be reviewed for acceptability.

B. Silicone Sealants (Low-Modulus)

1. Dow Corning Corp.
2. GE Silicones
3. Pecora

C. Acrylic Emulsion Latex Sealants

1. Pecora
2. Tremco
3. Sonneborn Building Products

D. Polyurethane Sealants

1. Sika Corp.
2. Pecora
3. Sonneborn Building Products
4. Tremco

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

1. Vertical Joint Sealant Color: Provide color to match as closely as possible the brick or Masonry unit (CMU) color. Where two brick colors are in the same façade, provide sealant colors to closely match each brick area.
2. Horizontal Joint Sealant Color: Provide color to match the grout color.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.4 SEALANT TYPES

A. Manufacturer’s products indicated are Basis of Design. Other manufacturers products complying to specified criteria will be considered.

B. Silicone Sealant for Exterior: ASTM C 920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding.

1. Product: 790 manufactured by Dow Corning Building Sealant.
2. Movement Capability: Plus 100 percent, minus 25 percent.
3. Service Temperature Range: -65 to 180 degrees F (-54 to 82 degrees C).
4. Shore A Hardness Range: 15 to 35.
5. Location Applications:

    a. Exterior joints.

b. Control, expansion and soft joints in masonry.
c. Joints between concrete and other materials.
d. Joints between metal frames and other materials.
e. Butt glazing.
f. Joints between precast architectural and precast structural concrete joints with precast concrete and other materials.

C. Fixtures/Tile Sealant: Silicone; ASTM C 920, Uses M, NT, O and A; single component, mildew resistant.

1. Product: 786 Mildew Silicone Sealant manufactured by Dow Corning.
2. Product: Sanitary 1700 manufactured by GE Silicones.
3. Location Applications: Interior uses only.

a. Joints between plumbing fixtures and floor and wall surfaces.
b. Joints between kitchen and bath counter tops and wall surfaces.
c. Joints between counter tops (with sinks) and wall surfaces.
d. Color to match adjacent materials.

D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, single component, paintable.

1. Product: Sonolac manufactured by Sonneborn Building Products Div.
2. Product: Tremco Acrylic Latex 834 manufactured by Tremco Inc.
3. Product: AC-20 manufactured by Pecora Corp.
4. Location Applications:

a. Interior wall and ceiling control joints.
b. Joints between door and window frames and wall surfaces.
c. Joints between casework and adjacent surfaces.
d. Other interior joints for which no other type of sealant is indicated.

E. Interior Floor Joint Sealant: Polyurethane, self-leveling: ASTM C 920, Grade P, Class 25, Uses T, M, O and A, multi-component.

1. Approved by manufacturer for wide joints up to 1-1/2 inches.
2. Product: SL2 manufactured by Sonneborn Building Products Div.
3. Location Applications:

a. Expansion joints in floors.

2.5 SOLVENT-RELEASE JOINT SEALANTS

A. Acrylic-Based Solvent-Release Joint Sealant: Comply with ASTM C 1311 or FS TT-S-00230.

1. Manufacturer's Products:

a. Schnee-Moorehead, Inc.; Acryl-R Acrylic Sealant.
b. Tremco; Mono 555.
c. Other manufacturers acceptable to the Architect.

B. Butyl-Rubber-Based Solvent-Release Joint Sealant: Comply with ASTM C 1085.

1. Manufacturer's Products:

a. Bostik Findley; Bostik 300.

b. Fuller, H. B. Company; SC-0296 or SC-0288.
c. Pecora Corporation; BC-158.
d. Polymeric Systems Inc.; PSI-301
e. Sonneborn, Division of ChemRex Inc.; Sonneborn Multi-Purpose Sealant.
f. Tremco; Tremco Butyl Sealant.

C. Pigmented Narrow-Joint Sealant: Manufacturer's standard, solvent-release-curing, pigmented, synthetic-rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16 inch (5 mm) or smaller in width.

1. Manufacturer's Products:

a. Fuller, H. B. Company; SC-0289.
b. Schnee-Morehead, Inc.; SM 5504 Acryl-R Narrow Joint Sealant.
c. Other manufacturers acceptable to the Architect.

2.6 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

B. Manufacturer's Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.7 PREFORMED JOINT SEALANTS

A. Preformed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Manufacturer's Products:

a. Dow Corning Corporation; 123 Silicone Seal.
b. GE Silicones; UltraSpan US1100.
c. Pecora Corporation; Sil-Span.
d. Tremco; Spectrem Ez Seal.

B. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:

1. Manufacturer's Products:

a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
b. illbruck Sealant Systems, Inc.; Wilseal 600.

c. Polytite Manufacturing Corporation; Polytite B.
d. Polytite Manufacturing Corporation; Polytite Standard.
e. Sandell Manufacturing Co., Inc.; Polyseal.

2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

a. Density: Manufacturer's standard.

2.8 PREFORMED TAPE SEALANTS

A. Back-Bedding Mastic Tape Sealant: Preformed, butyl-based elastomeric tape sealant with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.

B. Expanded Cellular Tape Sealant: Closed-cell, PVC foam tape sealant; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800.

2.9 JOINT-SEALANT BACKING (BACKER ROD)

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or

harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates.

B. Joint Priming: Prime joint substrates, where required, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint, unless otherwise indicated.

H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates.

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

3.6 PROTECTION

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

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hollow doors and frames.
2. Sidelight frames
3. Borrowed-light frames.
4. Fire-rated door and frame assemblies.
5. Louvers in hollow metal doors

B. Related Sections include the following:

1. Division 04 2000 Section "Unit Masonry" for installing anchors and grouting frames in masonry construction.
2. Division 05 4000 Section "Formed-Metal Fabrications" for customized hollow-metal work other than doors, panels, and frames.
3. Division 08 1416 Section "Flush Wood Doors" for wood doors installed in steel frames.
4. Division 08 7200 Section "Door Hardware" for door hardware and weather stripping.
5. Division 08 8000 Section "Glazing" for glass in glazed openings in doors and frames.
6. Division 09 2900 Section "Gypsum Board" for spot-grouting frames installed in steel-framed gypsum board partitions.
7. Division 09 9100 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

B. Steel Door Institute (SDI): SDI Level for minimum steel sheet thickness for door faces.

1.4 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:

1. Elevations of each door design.

2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Coordination of glazing frames and stops with glass and glazing requirements.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

D. Oversize Construction Certificates: For door assemblies required to be fire-protection rated and exceeding size limitations of labeled assemblies.

1.5 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Remove and replace damaged items.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation and ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hollow Doors and Frames:

a. Amweld Building Products, Inc.
b. Ceco Door Products; a United Dominion Company.
c. Detroit Door.
d. Pioneer Industries Inc.
e. Republic Builders Products.
f. Steelcraft; a division of Ingersoll-Rand.
g. Mesker Door Incorporated.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 HOLLOW METAL DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated per SDI level ratings.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level-2 and Physical Performance Level-B (Heavy Duty), Model-1 (Full Flush).
2. Steel thickness: 18 gauge, fully welded unit.
3. Fire-rated doors and door frames where indicated in Schedule. Provide UL -label.

C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level-3 and Physical Performance Level-A (Extra Heavy Duty), Model-2 (Seamless).
2. Steel thickness: galvanized 16 gauge, fully welded unit.

D. Vision-Lite Systems: Manufacturer's standard kits consisting of glass-lite moldings to accommodate glass thickness and size of vision-lite indicated

2.4 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frame minimum steel thickness:

1. Interior – 18 gauge
2. Exterior – 16 gauge (galvanized).
3. Frames spaced 48” and wider – 14 gauge.
4. Fire Rating Frames: Provide UL -label the same rating as indicated for the door.

C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

D. Plaster Guards: Provide 0.016-inch- (0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

E. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

G. Provide ½" thick by 1-3/4" wide full height filler strip of styrofoam behind hinge jamb to allow for drilling and topping for continuous hinge in field, where continuous hinges are indicated..

H. Grout-filled Frames and Door Frames:

1. Where frames are indicated to be grouted or grout-filled, the inside of the frame must be installed with an asphaltic paint or an application of water-repellent sealer to prevent corrosive action to the steel frame.

2.5 LOUVERS IN HOLLOW METAL DOORS

1. General: Provide clear anodized aluminum louvers in hollow metal door frames as indicated.

2. Louver Basis of Design: Price Transfer/Door Grilles type ATG 1 with 1 ¼" flat border on one side only. Concealed fastening.

3. Louvers to be mounted to classroom side of door.

4. Provide louvers in dimensions indicated with 50% free opening.

2.6 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

C. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:

1. Cold-rolled steel sheet, unless otherwise indicated.
2. Metallic-coated steel sheet where indicated.

D. Core Construction: One of the following manufacturer's standard core materials that produce a door complying with SDI standards:

1. Resin-impregnated kraft/paper honeycomb.
2. Polyurethane.
3. Polystyrene.
4. Vertical steel stiffeners.
5. Rigid mineral-fiber board.

E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 1/4 inch (6.4 mm) at bottom to flooring or thresholds. Coordinate with other trades.

F. Clearances for Fire-Rated Doors: As required by NFPA 80.

G. Single-Acting, Door-Edge Profile: Beveled edge, unless square edge is indicated.

H. Double-Acting, Door-Edge Profile: Round vertical edges with 2-1/8-inch (54-mm) radius.

I. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

J. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

K. Exposed Fasteners: Provide countersunk flat or oval heads for exposed screws and bolts where acceptable by the Architect.

L. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.

M. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested according to ASTM E 1408, and classified according to ASTM E 413.

1. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 33 or greater.

N. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

O. Frame Construction: Fabricate frames to shape shown.

1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.

2. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
3. Provide welded frames with temporary spreader bars.
4. Provide terminated stops where indicated.

P. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

Q. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

R. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.

1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

S. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.7 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

B. Factory-Applied Paint Finish: Manufacturer's standard, factory-applied paint finish complying with ANSI A250.3 for performance and acceptance criteria.

1. Finished paint coat will be field applied unless otherwise noted.
2. Refer to drawing schedules for color and finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.

4. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
5. For existing gypsum board partitions, knock-down, drywall slip-on frames are acceptable.
6. Install fire-rated frames according to NFPA 80.
7. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
2. Smoke-Control Doors: Install to comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08 1113

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core wood doors with wood-veneer.
2. Fire-rated solid wood doors.
3. Factory finishing flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.
5. Louvers and Glazing for flush wood doors.
6. Door information is scheduled in the Drawings.

B. Related Sections include the following:

1. Division 06 4023 Section "Interior Architectural Woodwork" and "Paneling" for requirements for veneers from the same flitches for both flush wood doors framed openings, and wood paneling.
2. Division 08 7200 Section "Door Hardware" for hardware for wood doors and frames.
3. Division 08 8000 Section "Glazing" for glass view panels in flush wood doors.
4. Division 09 9100 Section "Painting" for factory finished doors.

1.3 SUBMITTALS

A. Product Data: For each type of door.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and other pertinent data as follows:

1. Dimensions and locations of mortises and holes for hardware.
2. Dimensions and locations of cutouts for glass, louvers and other items.
3. Requirements for veneer matching.
4. Doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.
6. Indicate glazing type on wood doors.

C. Samples for Verification:

1. Manufacturer's standard factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI - "Architectural Woodwork Quality Standards Illustrated" or WDMA I.S.1-A, "Architectural Wood Flush Doors."

1. Provide AWI Quality Certification Labels or a letter from WDMA certifying the of licensing for Project indicating that doors comply with requirements of grades specified.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill or Positive Pressure CAT –A.
2. Locate UL labels on fire-rated doors at hinged side.
3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 250 deg F (135 deg C) maximum in 30 minutes of fire exposure.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 3100 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package doors individually in plastic bags or cardboard cartons.

B. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship.

1. Warranty shall also include installation and finishing.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid-Core Exterior and Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products only from one of the listed manufacturers. Products from other manufacturers, not listed here-in will be required to submit a "Substitution Request" on the Architect's form located in Specification Section 01 6000

1. Flush Wood Doors (Solid):

    a. Eggers Industries – Architectural Door Division.
    b. Algoma Hardwoods.
    c. Mohawk Flush Doors, Inc.
    d. Oshkosh Architectural Door Co.
    e. Marshfield Door Systems, Inc.
    f. VT Industries.

2.2 DOOR CONSTRUCTION, GENERAL

A. Adhesives: Do not use adhesives containing urea formaldehyde.

B. Door Construction: Construct door framing with either structural composite lumber or staved solid wood lumber.

1. Internal Framing Lumber: Top, intermediate and bottom rails shall be at least 1-1/8 inch wide frame where doors will not receive door closers.

    a. Provide at the top rail a 5-1/4 inch wide frame solid lumber to prevent thru-bolting of hardware closers.
    b. Coordinate with Hardware schedules.

2. Internal Framing Lumber: Top, intermediate and bottom rails and stiles shall be at least 5-1/4 inches wide of structural composite or solid lumber to prevent thru-bolting of door hardware closers and other door hardware items. Coordinate with Hardware schedules.

C. Doors for Transparent Finish:

1. Grade: Grade A faces and veining without heartwood.
2. Species and Cut: **to match existing**
    a. The intent is to match the existing interior wood doors. Visit the project site during the bid phase and notify the Architect if the existing door species and cut is not plain sliced red oak.
3. Match between Veneer Leaves: Slip match, unless otherwise indicated on Drawings.
4. Assembly of Veneer Leaves on Door Faces: Running vein, unless otherwise indicated.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 20 feet (6 m) or more.
7. Transom Match: End match.

D. Door Sizes: Provide standard and custom door sizes and thickness as indicated or scheduled in the Drawings.

2.3 SOLID-CORE DOOR CONSTRUCTION

A. Interior Veneer-Faced Doors:

1. Core: Either glued block or structural composite lumber.
2. Construction: Five plies with stiles and rails bonded to core, and entire unit abrasive planed before veneering.
3. Construction: Five plies, bonded construction.
4. Internal Framing Lumber: Top, bottom, intermediate rails and vertical stiles. Refer to Door Construction specifications described in this Section.

B. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire-rating indicated.
2. Blocking: For mineral-core doors, provide structural composite lumber blocking with improved screw-holding capability for use in doors of fire ratings and indicated as follows:

    a. 5-1/4-inch minimum top-rail blocking.
    b. 5-1/4 inch minimum intermediate and mid-rail blocking.
    c. 5-1/4-inch minimum bottom-rail blocking.
    d. 5-1/4-inch minimum vertical stiles.

3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
5. Pairs: Furnish formed-steel edges and astragals with concealed intumescent seals for pairs of fire-rated doors.

    a. Cover steel edges and astragals with same wood species color as door faces.

6. Pairs: Provide fire-rated pairs with fire-retardant stiles matching wood face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Provide fire-rated astragals matching wood veneer door faces.

2.4 WOOD LOUVERS AND VISION FRAMES

A. Louvers and Vision Frames: Door manufacturer's standard solid-wood louvers, unless otherwise indicated.

1. Wood to match door wood species.
2. Louvers are not permitted in fire-rated doors.

2.5 FABRICATION

A. Fabricate doors in sizes indicated for Project-site fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

D. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

E. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Provide manufacturer’s standard trim openings with moldings, unless otherwise indicted on Drawings.
2. Louvers: Factory install louvers in prepared openings.

2.6 SHOP PRIMING

A. Doors for Transparent Finish: Shop seal faces and edge of doors, including cutouts, with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section "Wood Stains."

2.7 FACTORY FINISHING

A. General: Comply with AWI "Architectural Woodwork Illustrated" or WDMA Architectural finishes.

B. Opaque finished door: Install paint primer for field finished doors.

C. Finish doors at factory that are indicated to receive finished stain or transparent finish.

D. Finish doors at factory where indicated in schedules or on Drawings.

E. Transparent and Stained Finishes:

1. Grade: Premium.
2. Stain color – where indicated: Selected by the Architect.
3. Finish: Manufacturer's standard finish comparable to AWI System TR-6 catalyzed polyurethane or WDMA System TR-6 catalyzed polyurethane finish.
4. Effect: Manufacturer’s standard filled finish.
5. Sheen: Satin (Low luster).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.
3. Reject doors that do not comply with the Architect's approved sample.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining. Correct wood frames not properly installed before proceeding with door installation.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/8 inch clearance from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.
    a. Comply with NFPA 80 for fire-rated doors.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 08 2133 – FLUSH FIBERGLASS REINFORCED POLYESTER (FRP) DOORS,

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work in this section.

1.2 SUMMARY

A. Provide each type of door and frame as shown on the drawings and in Drawing door schedules.

B. This section includes, but is not limited to, the following:

1. Fiberglass Reinforced Polyester (FRP) flush doors.

C. Related sections include the following:

1. Division 07 9200 Section “Joint Sealants”.
2. Division 08 4113 Section “Aluminum-Framed Entrances and Storefronts” for coordination to adjacent framing.
3. Division 08 7200 Section “Door Hardware.” for coordination of door hardware.
4. Division 08 8000 Section “Glazing (glass).”

1.3 SYSTEM PERFORMANCE-FIBERGLASS REINFORCED POLYESTER (FRP) FLUSH DOORS

A. Provide door assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below, as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.

B. Air Infiltration: For a single door 3’-0” x 7’-0”, test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.

C. Thermal Transmission, Exterior doors; U-value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.

D. Surface Burning Characteristics; FRP Doors and Panels, ASTM E 84:

1. Flame Spread: Maximum of 200, Class C.
2. Smoke Developed: Maximum of 450, Class C.

E. Additional Criteria: Provide FRP doors and panels with the following performance or better:

1. Impact Strength: ASTM D 256 - nominal value of 15.0.
2. Tensile Strength: ASTM D 638 – nominal value of 14,000 psi.
3. Water Absorption: ASTM D 570 - nominal value of 0.20 to after 24 hours.
4. Indentation Hardness: ASTM D 2583 - nominal value of 55.
5. Flexural Strength: ASTM D 790 – 21,000 psi.
6. Swinging Door Cycle Test: ANSI A250.4 – Minimum of 20,000,000 cycles.
7. Swinging Security Door Assembly, Doors and Frames: ASTM F 476 – Grade 40.

1.4 SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS – STOREFRONT SYSTEMS AND DOOR PERIMETER FRAME SYSTEMS

A. General: Provide thermal-break or thermally-improved aluminum entrance and storefront assemblies that comply with specified performance characteristics.

B. Thermal Movement: Design framing systems to provide for expansion and contraction of component materials.

C. Performance Requirements: AAMA/NWWDA 101/I.S.2.

1. Rating: F-AW60 90 x 96.
2. Air Infiltration, ASTM E 283, 6.24 psf (50 mph): less than 0.01 cfm. per sq. ft.
3. Water Resistance, ASTM E 331:15.0 psf.
4. Overall Design Pressure, ASTM E 330: 60.0 psf, positive and negative.
5. Structural Test Pressure, ASTM E330: 90.0 psf, positive and negative.
6. Forced Entry Resistance, ASTM F 588: Grade 40.

D. Thermal Performance:

1. Condensation Resistance Factor (CRF) AAMA 1503: 54.
2. Thermal Transmittance AAMA 1503: 0.69 Btu/hr-sq ft-F.
3. Standardized Thermal Transmittance (U-Factor) (Ust), NFRC 100: 0.64 Btu/hr-sq ft-F.

1.5 QUALITY ASSURANCE

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. Manufacturer’s Qualifications: Provide entrances and storefronts produced by a single manufacturer with not less than twenty (20) years of successful experience in the fabrication of assemblies of the type and quality required.

C. Installer’s Qualifications: Entrances and Storefronts shall be installed by a firm in continuous business with at least five (5) years of successful experience in the installation of systems similar to those required.

1. Bidders and installers shall be factory trained distributors and approved by the FRP Door Manufacturer.

D. Design Criteria: Drawings indicate typical sizes, spacing of members, profiles and dimensional requirements of entrance and storefront work. Minor deviations will be reviewed by the Architect for acceptance in order to utilize manufacturer standard products. Architect’s sole judgment shall prevail that such deviations do not materially detract from the design concept intended performances.

E. Field Measurement: Field verify all information prior to fabrication and furnish all materials and additional accessories to suit door construction for hardware.

F. 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 current Americans with Disabilities Act (ADA).

1.6. SUBMITTALS

A. Product Data: Submit Manufacturer's product data, specifications and instructions for each type of door and frame required.

1. Include details of core, stile and rail construction, trim for lites and all other components.
2. Include details of door 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 one-half full size. Include elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, framing, glazing, and door hardware schedule.

C. Maintenance Manual: Submit manufacturer’s maintenance and cleaning instructions for all systems.

D. Warranty: Submit manufacturer’s standard warranties.

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 cartons protected so no portion of the door has contact with the outer shell of the container.

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.

1. Fiberglass Reinforced Polyester (FRP) door warranty period – ten (10) years.
2. Aluminum Storefront Framing Systems – ten (10) years.
3. Factory applied hardware installation – ten (10) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass Reinforced Polyester Doors: Subject to compliance with requirements, provide products from one of the following:

1. Manufacturer’s Product – Basis-of-Design:

a. Manufacturer: Vale Doors, Collingdale, PA

b. Product: Match existing door style and color per building - varies
c. Color and Finish: Selected by Architect from Manufacturer's full range.

2. Acceptable Manufacturers complying with specified Basis-of-Design requirements.

a. Special-Lite, Inc
b. Commerical Door Systems
c. Vale Doors

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, 18-8 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.

D. Glazing Gaskets: Gaskets installed in captive assembly of glazing stops.

1. EPDM: ASTM 2000.
2. Closed-Cell Foam: ASTM D 1667.

E. Concealed Flashing: Provide 26 gage minimum dead-soft stainless steel, or 0.026" minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components.

F. Brackets and Reinforcements: Where feasible, provide high-strength aluminum brackets and reinforcements; otherwise provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.

G. Compression Weather-stripping: Provide the manufacturer's standard replaceable compressible weather-stripping gaskets.

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. Door frame stops shall be applied stops, minimum 0.625" high x minimum 1 ¼" wide.

H. Door attachment points shall be minimum of 1/8" thickness.

I. 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 12" long shall be securely attached to the frame tube.

J. Where it is not practical to have solid bar stock reinforcement at attachment points, use "RIV-NUTS" for attachment of hardware items.

2.4. FIBERGLASS REINFORCED POLYESTER (FRP) FLUSH DOORS

A. Materials and Construction

1. Construct 1-3/4" thickness, Stiles and Rails, 6063-T5 aluminum alloy, minimum of 2-5/16-inch depth, mitered or square butt corners.
2. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
3. Securing internal door extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
4. Furnish integral reglets to accept face sheet to permit a flush appearance. Rail caps or other face sheet capture methods are not acceptable.
   a. Color: Same color as the FRP door color.
5. Extrude top and bottom rail legs for interlocking continuous rail rigidity weather bar and reinforcement for door hardware.
6. Door Face Sheeting: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface. Color and Finish as selected by Architect from Manufacturer's full range of FRP colors.
   a. Aluminum trim to match FRP door color.
7. Core of Door Assembly: Minimum five (5) pounds per square inch density foamed-in-place polyurethane free of CFC and HCFC. Minimum "R" value of 9. Meeting stiles on pairs of doors, and weather bars with nylon brush weather-stripping.
8. Manufacture doors with cutouts for vision-lites, louvers or panels. Factories furnish and install all glass, louvers and panels prior to shipment.
9. Premachine doors in accordance with templates from the specified door hardware manufacturers and approved hardware schedule. Factories install hardware.
10. Furnish pulls for each door leaf unless the hardware specification requires other applications (Ex: lever handle lockset).
    a. Manufacturer's Product Basis-of-Design: Special-Lite "SL82 pulls" or approved equal acceptable to the Architect.
11. Provide internal 1/8" aluminum reinforcement for specified hardware configurations to prevent any "thru-bolting" of door hardware connections. Thru Bolting of door closers is not permitted.
12. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of doors.

2.6. GLAZING

A. Design system for replacement of glass.

1. Manufacturer's standard flush glazing system of recessed channels and captive glazing gaskets or applied stops as shown.
2. Allow for thermal expansion on exterior units.
3. Glass as indicated or as selected by the Architect and factory glazed into doors.

2.9. DOOR HARDWARE

A. Refer to Division 08 Section “Door Hardware” for Finish Hardware.

B. Factory install all light kits, glass and louvers in doors.

C. Factory install all hardware on doors and frames.

1. Door Hardware supplier to deliver all hardware to FRP manufacturer.
2. Includes but is not limited to: Hinges, Pivots, Flush bolts, Dummy Trim, Door Position Switches, EPT’s, Electric Strikes, Magnetic Locks, Locksets, Lockset Trim and Cylinders, Panic Exit Devices, Door Pulls, Push Plates, Push and Pull Bars, Carry Bars, Concealed Door Closers, Concealed Door Stops, Kick Plates, Mop Plates, Armor Plates, Weather-stripping and Gasketing.
3. Does not include: Surface Mounted items that require different locations based on degree of swing of door, Thresholds.

PART 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 side-lites 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 back-seal.

D. Clean surfaces promptly after installation of doors and frames, exercising care to avoid damage to the protective coatings.

E. Repair doors and frames that are damaged to as new and replace deteriorated doors and frames as directed by the Architect.

F. Provide Owner with all adjustment tools and instruction sheets. Arrange an in-service session to Owner at Owner's convenience. Any workmanship that is defective or deficient shall be corrected to the Owner's satisfaction and at no additional cost to the Owner.

END OF SECTION 08 2133

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Standard and Fire-Rated access doors and frames for walls and ceilings.
2.

B. Related Sections include the following:

1. Division 03 3000 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
2. Division 04 2000 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
3. Division 07 7200 Section "Roof Accessories" for roof hatches.
4. Division 08 7200 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
5. Division 09 5123 Section "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Submit color chart.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1. Provide access doors for access to electrical and mechanical controls in walls and ceilings to suit affected trades. Access location – Refer to Electrical and Mechanical drawings.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

1. ASTM A 123/A 123M, for galvanizing steel and iron products
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

   a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
4. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
5. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

F. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

G. Plaster Beads: Casing bead formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. General: Provide Access doors and Frames for access to Electrical controls and Mechanical valves and Smoke Dampers and where required. Provide a 12 x 12 inch access unit.

1. Refer to Electrical and Mechanical Drawings for locations.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Cendrex Inc.
4. Jensen Industries.
5. J. L. Industries, Inc.
6. Larsen's Manufacturing Company.
7. Milcor Inc.
8. Nystrom, Inc.
9. Williams Bros. Corporation of America (The).

C. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel, metallic-coated steel or stainless-steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum **0.060-inch- (1.5-mm-)** thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum **0.060-inch- (1.5-mm-)** thick sheet metal with **1-1/4-inch- (32-mm-)** wide, surface-mounted trim.
4. Hinges: Continuous piano.
5. Latch: Self-latching bolt operated by screwdriver with interior release.

6. Lock: Cylinder.

D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel, metallic-coated steel or stainless-steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of **0.036 inch (0.9 mm)**.
5. Frame: Minimum **0.060-inch- (1.5-mm-)** thick sheet metal with **1-inch- (25-mm-)** wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by flush key with interior release.
9. Lock: Self-latching device with cylinder lock.

a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal **1 to 1-1/2 inches (25 to 38 mm)** wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.
3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 3113

SECTION 08 4113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes, but not limited to the following:

1. Exterior and interior storefront framing.
2. Aluminum finishes.

B. Related Sections:

1. Division 07 9200 Section "Joint Sealants” as part of the entrance system.
2. Division 08 2133 Section " Flush Fiberglass Reinforced Polyester (FRP Doors)
3. Division 08 4413 Section "Glazed Aluminum Curtain Walls" for curtain-wall systems that mechanically retain glazing on four sides.
4. Division 08 7200 Section “Door Hardware.”
5. Division 08 8000 Section “Glazing” (glass) for types of glass.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Provide a thermally-improved Aluminum-framed systems that will withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.

3. Failure includes, but not limited to the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and by thermal and structural movements.

f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:

1. Wind Loads:

a. Basic Wind Speed: Minimum **85 mph (38 m/s)** and as indicated.

b. Positive Wind Load: 30 lbs./sf (1436 Pa) minimum.

c. Negative Wind Load: 30 lbs/sf (1436 Pa) minimum.

2. Dead Loads: Provide Store Front entrance systems that will not deflect an amount which will reduce bite below 75 % of design dimensions when carrying full dead load.

3. Live Loads: Provide Store Front entrance systems, including anchorage, that accommodate live loads indicated without failure of materials or permanent deformation.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of **0.06 cfm/sq. ft. (0.03 L/s per sq. m)** of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of **6.24 lbf/sq. ft. (300 Pa)**.

G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than **6.24 lbf/sq. ft. (300 Pa)**.

H. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than **6.24 lbf/sq. ft. (300 Pa)**.

1. Maximum Water Leakage: According to AAMA 501.1 and no uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

I. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of **180 deg F (82 deg C)**.
b. Low Exterior Ambient-Air Temperature: **0 deg F (minus 18 deg C)**.

3. Interior Ambient-Air Temperature: **75 deg F (24 deg C)**.

J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

K. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than **0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K)** when tested according to AAMA 1503.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

D. Field quality-control reports.

E. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Adhesive or cohesive sealant failures.
   e. Water leakage through fixed glazing and framing areas.
   f. Failure of operating components.

2. Warranty Period: Two (2) years from Contractor’s date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers Product – Basis of Design

1. Storefront #1
   a. Manufacturers: Tubelite
   b. Design Series: Store Front Standard T14000 Series IO, screw spline.
   c. Section Size: 2" x 4 ½"
   d. Color/Finish:
      1) Match existing – green

B. Manufacturers: Subject to compliance with requirements, provide the Basis-of-Design product or comparable product by one of the following:

1. Amarlite Architectural Products.
2. Arcadia, Inc.
3. Cross Aluminum Products.
4. EFCO Corporation.
5. Kawneer North America; an Alcoa company.
6. TRACO.
7. Tubelite.
8. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
9. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials or dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:

1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.

a. Color: Black unless as selected by Architect from manufacturer's full range of colors.

2. Weather-seal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weather-seal sealant, and aluminum-framed-system manufacturers for this use.

   a. Color: Matching structural sealant.

2.5 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 9200 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system, head-and-sill-receptor system with shear blocks at intermediate horizontal members.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. Aluminum Members: ASTM B 221 for extrusions, ASTM B 209 for sheet/plate; alloy and temper recommended by the manufacturer for the strength required, for corrosion resistance, and for the finish required.

1. Type AL-1 Colored Anodized Aluminum Finish – Natural Clear Aluminum Satin Finish – match existing

Class-2; Match existing: AA-M12C22/A31
(Nonspecular, as-fabricated Mechanical finish; medium etched matte chemical finish; clear, Architectural Class-2 anodic coating, minimum 0.4 mil thick). Comply with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weather-tight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weather-tight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:

    a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

A. Testing Services: When requested by Owner, provide testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.03 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of **6.24 lbf/sq. ft. (300 Pa)**.

    a. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10 percent, 35 percent, and 70 percent completion.

2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum **uniform and cyclic** static-air-pressure difference of **0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft. (200 Pa)**, and shall not evidence water penetration.

    a. Test Area: One bay wide, but less than 30 feet (9m), by 1 story of aluminum-framed systems.
    b. A minimum of two (2) tests in areas as directed by Architect.

3. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

a. Test Area: A minimum area of 75 feet (23 m) by 1 story of aluminum-framed systems.

B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 08 4113

SECTION 08 4500

Translucent Wall and Roof Assemblies

PART 1GENERAL

1.1 SECTION INCLUDES

A. Translucent daylighting system.

1.2 RELATED SECTIONS

A. Section 08 84 00 - Translucent Plastic Glazing.

1.3 REFERENCES

A. ASTM D 635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.

B. ASTM D 1929 – Ignition Temperature of Plastics.

C. ASTM D 2843 – Density of Smoke.

D. ASTM E 84 - Surface Burning Characteristics of Building Materials.

1.4 DESIGN REQUIREMENTS

A. Basic Wind Speed: 90 mph.
(If alternate loading is required please contact Duo-Gard)

B. Exposure Category: designed to required category, contact manufacturer.

C. Maximum Allowable Deflection of Structural Members: Maximum of L/120 of clear span.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including materials, components, fabrication, finish, and installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, profiles, anchorage, connections, fasteners, hardware, provisions for expansion and contraction, drainage, aluminum flashing, finish, and attachments to supports of glazing, framing, and options.

D. Samples: Submit manufacturer’s samples for each glazing type, framing system, finish, and color specified.

E. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

F. Manufacturer’s Project References: Submit list of completed projects including project name and location, name of architect, and type of daylighting manufactured.

G. Warranty: Submit manufacturer's standard warranty.

H. Testing Reports: Submit manufacturer's test reports.
   a. Fire tests.
   b. Air infiltration test.
   c. Water penetration test.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Continuously engaged in translucent daylighting manufacturing with a minimum of 10 years successful experience.
   2. Able to demonstrate successful performance on comparable projects.
   3. Responsible for all components, including structural design.

B. Installer's Qualifications:
   1. Authorized by manufacturer to install translucent glazing products.
   2. Trained by manufacturer's standard training methods and policies.

C. Approved Manufacturers:

D. All manufacturers acceptable for use on this project must be approved prior to bid. Manufacturers must submit evidence of compliance with all performance criteria specified including test reports. Any exceptions taken from this specification must be noted on the approval request. If approval is given, product performance will be as specified. Should non-compliance be subsequently discovered, the previously given approval will be invalidated and use of the product on the project will be disallowed. Requests for approval, with all appropriate submittal data and samples must be received no less than 15 days prior to bid date. A list of all approved manufacturers and products will be issued by addendum. No other manufacturers will be acceptable. No verbal approval will be given.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, and location of installation.

B. Storage:
   1. Store materials in a clean, dry area indoors in accordance with manufacturer's instructions.
   2. Keep temporary protective liners in place.
   3. Do not expose panels to direct sunlight for extended periods.

1.8 WARRANTY

A. Warranty Period: Ten years on weatherization starting on date of substantial completion.

PART 2PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Duo-Gard Industries Inc., 40442 Koppernick Road, Canton, Michigan 48187. Phone (734) 207-9700. Fax (734) 207-7995. Web Site: www.duo-gard.com.

2.2 GLAZING

A. Product: Series 3000 Base plate and low profile pressure cap system glazed with

a. Polycarbonate structured sheet.
b. Glass fiber reinforced thermoset resin (fiberglass) faces are not acceptable.

B. Panel Thickness: 25 mm.

C. Profile: triple wall.

D. Color: Manufacturer's standard – clear, bronze, opal.

E. U-Value, ASTM C 236: 0.40

F. Light Transmission. ASTM D 1003: 74 percent (clear)
37 percent (bronze)
52 percent (opal)

G. Fire Tests:
1. Smoke Developed, ASTM D 635: CC1.
2. Ignition Temperature, ASTM D1929.
3. Density of smoke, ASTM D 2843.
4. Flame Spread, ASTM E 84: Class A.
5. Smoke Density, ASTM E 84: Class A.

2.3 STRUCTURAL FRAMING SYSTEM

A. Framing system: Series 3000 BPC system with low profile pressure cap for easy water flow.
1. Alloy: 6063 T5.

B. Combined maximum deflection: 1 inch.

C. Provide additional aluminum structure where and if required.

D. Glazing system required to span maximum 6 feet (sloped) without additional support.

E. Air infiltration, ASTM E 283-1999: Leakage not to exceed 0.04 when tested at 1.57 psf and not to exceed 0.07 when tested at 6.24 psf.

F. Water penetration, ASTM E 331-2000: No water leakage at 30 psf.

G. Recommended minimum slope: 2:12.

H. Direct contact between polycarbonate system components is not acceptable including but not limited to polycarbonate battens.

I. Framing system must allow polycarbonate panel to 'float' in the channel to accommodate for expansion and contraction.

2.4 MATERIALS

A. Glazing Panel:

1. Panel: Polycarbonate structured sheet.
2. UV Stabilization: Coextruded into panel, not coated.
3. Resist Yellowing: Maximum 10 delta for a minimum of 10 years.
4. Appearance: Uniform in color.
5. Expansion and Contraction: Design and install components with provisions based on temperature variation for specified geographic location.
6. Gaskets and Dry Seals: EPDM and TPV (Santoprene).
7. Produced: USA certificate of origin required. Panels produced outside of USA will not be allowed.

B. Joint Sealant:
1. Factory-Applied Sealant: Gunnable, nonhardening, elastomeric sealant. ASTM C 920, Type S, Class 12, Grade NS. Fed Spec TT-S-1657, Type 1.n.

2. Field-Applied Sealant: Approved by translucent daylighting manufacturer. As specified elsewhere in specifications.

C. Field Fasteners:
1. Comply with translucent daylighting manufacturer's instructions for fastener types, quantities, and usage.
2. Cadmium-plated or better. Prevent oxidation or electrolytic interaction with framing.
3. Aluminum-to-Aluminum Connections: Self-drilling screws, size and length as determined by manufacturer.

2.5 COLOR AND FINISH

A. Panel Color:
1. Manufacturer's standard – clear, bronze, opal.
(other colors available, please contact Duo-Gard)

B. Aluminum Finish:
1. Manufacturer's standard - clear anodized.
(other finishes available, please contact Duo-Gard)

PART 3EXECUTION

3.1 EXAMINATION

A. Examine areas to receive translucent daylighting. Notify Architect of conditions that would adversely affect installation or subsequent utilization of daylighting. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure supports to receive translucent insulated daylighting are clean, flat, level, plumb, square, accurately aligned, and correctly located.

3.3 INSTALLATION

A. Install translucent insulated daylighting in accordance with manufacturer's instructions at locations indicated on the drawings.

B. Install daylighting level, plumb, square, accurately aligned, correctly located, and without warp.

C. Anchor daylighting securely in place to supports. Use attachment methods permitting adjustment

for construction tolerances, irregularities, alignment, and expansion and contraction.

D. Install daylighting including aluminum flashing, fasteners, hardware, gaskets, joint sealants, and glazing materials required for a complete, weathertight installation.

E. Sheet Metal Flashing: Install sheet metal flashing as specified elsewhere in specifications.

F. Joint Sealants: Install joint sealants as specified elsewhere in specifications.

G. Repair minor damages to metal finish or glazing in accordance with manufacturer's instructions and as approved by Architect. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

A. Clean translucent daylighting in accordance with manufacturer's instructions.

B. Clean inside and outside of daylighting immediately after installation and after joint sealants have cured.

C. Remove temporary protective liners at time of installation (interior) and after installation is complete (exterior).

D. Remove excess joint sealant in accordance with sealant manufacturer's instructions.

E. Do not use harsh cleaning materials or methods that would damage metal finish or glazing.

3.5 PROTECTION

A. Protect installed translucent daylighting from damage during construction.

B. Remove and replace damaged daylighting components as determined by Architect.

END OF SECTION

SECTION 08 7100 DOOR HARDWARE

PART 1 - GENERAL

1.1 Refer to "General and Special Conditions", and "Instructions to Bidders", Division 1 of Specifications. Requirements of these Sections and the project drawings shall govern work in this section.

1.2 Work Included:

A. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.

B. Related work:

1. Division 00 00 00 – Procurement and Contracting Requirements
2. Division 01 00 00 – General Requirements
3. Division 06 00 00 – Wood, Plastics, and Composites
4. Division 08 00 00 – Openings
5. Division 10 00 00 – Specialties
6. Division 11 00 00 – Equipment
7. Division 26 00 00 – Electrical
8. Division 27 00 00 – Communications
9. Division 28 00 00 – Electronic Safety and Security

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:

1. Cabinet Hardware.
2. Signs, except as noted.
3. Folding partitions, except cylinders where detailed.
4. Sliding aluminum doors
5. Chain link and wire mesh doors and gates
6. Access doors and panels
7. Overhead and Coiling doors

1.3 Quality Assurance

A. Requirements of Regulatory Agencies:

1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
3. Provide hardware for fire-rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been tested and listed

by UL for types and sizes of doors required and complies with requirements of door and door frame labels.

B. Hardware Supplier:

1. Shall be an established firm dealing in contract builders' hardware. He must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).

C. Electrified Door Hardware Supplier:

1. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
2. Shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this project.
3. Shall have experience in providing consulting services for electrified door hardware installations.

D. Pre-installation Meeting:

1. Before hardware installation, General Contractor/Construction Manager will request a hardware installation meeting be conducted on the installation of hardware; specifically that of locksets, closers, exit devices, overhead stops and coordinators. Manufacturer's representatives of the above products, in conjunction with the hardware supplier for the project, shall conduct the meeting. Meeting to be held at job site and attended by installers of hardware for aluminum, hollow metal and wood doors. Meeting to address proper coordination and installation of hardware, per finish hardware schedule for this specific project, by using installation manuals, hardware schedule, templates, physical product samples and installation videos.
2. When any electrical or pneumatic hardware is specified this meeting shall also include the following trades/installers: Electrical, Security, Alarm systems and Architect.
3. Convene one week or more prior to commencing work of this Section.
4. The Hardware Supplier shall include the cost of this meeting in his proposal.

E. Manufacturer:

1. Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
2. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

1.4 Submittals:

A. Hardware Schedule

1. Submit number of Hardware Schedules as directed in Division 1.
2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.

3. Schedule will include the following:
   a. Door Index including opening numbers and the assigned Finish Hardware set.
   b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	SPECIFIED	SCHEDULED
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

   c. Hardware Locations: Refer to Article 3.1 B.2 Locations.
   d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
   e. Hardware Description: Quantity, category, product number, fasteners, and finish.
   f. Headings that refer to the specified Hardware Set Numbers.
   g. Scheduling Sequence shown in Hardware Sets.
   h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
   i. Electrified Hardware system operation description.
   j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
   k. Typed Copy.
   l. Double-Spacing.
   m. 8-1/2 x 11 inch sheets
   n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:

1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
2. Submit product data with hardware schedule.

C. Samples:

1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Key Schedule:

1. Submit detailed schedule indicating clearly how the Owner's final keying instructions have been followed.
2. Submit as a separate schedule.

E. Electrified Hardware Drawings:

1. Submit elevation drawings showing relationship of all electrical hardware components to door and frame. Indicate number and gage of wires required.
   a. Include wiring drawing showing point to point wire hook up for all components.
   b. Include system operations descriptions for each type of opening; describe each possible condition.

F. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.5 Product Delivery, Storage, and Handling:

A. Label each item of hardware with the appropriate door number and Hardware Schedule heading number, and deliver to the installer so designated by the contractor.

1.6 Existing Conditions:

A. All existing hardware shall be field verified by the supplying distributor to confirm compatibility and determine required preparations. Where any incompatibility is discovered, the supplying distributor shall notify the architect immediately and provide the suggested solution based on industry standard business practices.

1.7 Warranties:

A. Refer to Division 1 for warranty requirements.

B. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. 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:

1. Furnish hinges of class and size as listed in sets.
2. Numbers used are Ives (IVE).
3. Products of a BHMA member are acceptable.

B. Pivot Sets:

1. Furnish Pivots as listed in sets.
2. Numbers used are Ives (IVE).
3. Products by Stanley and Hager are acceptable.

C. Continuous Gear Hinge:

1. 6063-T6 aluminum alloy, anodized finish (cap on entire hinge painted if specified). Manufacture to template, uncut hinges non-handed, pinless assembly, three interlocking extrusions, full height of door and frame, lubricated polyacetal thrust bearing, fasteners 410 stainless steel plated and hardened. All hinge profiles to be manufactured to template bearing locations, with standard duty bearing configurations at 5-1/8" spacing with a minimum of 16 bearings: and heavy duty at 2-9/16" spacing with a minimum of 32 bearings. Anodizing of material shall be done after fabrication of components so that all bearing slots are anodized.
2. Length: 1" less than door opening height. Fastener 12-24 x 1/2" #3 Phillips keen form stainless steel self-tapping at aluminum and hollow metal doors, 12- 1/2" #3 Philips, flathead full thread at wood doors.
3. Furnish fire rated hinges "FR" at labeled openings.
4. Numbers used are Ives.
   a. For Wood and Hollow Metal frames;
      1) Ives 224HD
      2) Equal products by Hager & Select will also be accepted.
   b. For Aluminum frames;
      1) Ives 112HD
      2) Equal products by Hager & Select will also be accepted.

D. Flush Bolts:

1. Constant Latching: metal doors:
   a. Ives FB50 Series
   b. Equal product of any B.H.M.A. member.
2. Constant Latching: wood doors:
   a. Ives FB60 Series
   b. Equal product of any B.H.M.A. member.
3. Manual – wood and metal doors:
   a. Ives FB458 Series
   b. Equal product of any B.H.M.A. member.
4. Dust Proof Strikes - furnish with all flush bolts, except at openings having thresholds:
   a. Ives DP2
   b. Equal product of any B.H.M.A. member.

E. 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 ¾" backset with a full ¾" 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 Schlage L583-363.
5. Function numbers are Schlage.
   a. Schlage L9000
6. Lockset Trim:

a. Schlage 03N

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.

F. 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. Provide cylinder dogging on panic exit hardware where noted in hardware sets.
10. Exit devices shall be UL listed panic exit hardware. All exit devices for fire rated openings shall be UL labeled fire exit hardware.
11. 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.
12. Von Duprin 98 and 35A Series. Series and function numbers as listed in sets.
13. Trim:
    a. As specified in sets.
    b. Levers to match lockset design where specified.

G. Removable Mullion:
    a. Interior/Exterior, mullion is removable only through the use of building keys.
        1) Von Duprin KR4954
    b. Interior Doors - UL listed, Mullion is removable only through the use of building keys.
        1) Von Duprin KR9954

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. Ives COR x length to suit.
   b. Equal products of any BHMA manufacturer

I. 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. LCN Series as listed in sets.

J. Overhead Holders and Stops:

1. Type, function and fasteners must be same as Glynn-Johnson specified. Size per manufacturer's selector chart. Plastic end caps, hold open mechanisms and shock blocks are not allowed. End caps must be finished same as balance of unit.
2. Manufacture products using base material of Brass/Bronze for US3, US4, & US10B finished products and 300 Stainless Steel for US32 & US32D finished products.
3. Type, function, and fasteners must be the same as Glynn-Johnson specified. Size per manufacturer's selector chart.
   a. Glynn-Johnson

K. Kick Plates:

1. Furnish .050 inches thick, beveled four sides, countersunk fasteners, 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.

L. Wall Stops:

1. Length to exceed projection of all other hardware. Provide with threaded studs and expansion shields for masonry wall construction. **Install with slope at top**.
   a. Ives WS33(X)
   b. BHMA L12011 or L12021

M. Thresholds:

1. 1/2" high - 5" wide. Cope at jambs.
2. Furnish full wall opening width when frames are recessed.

3. Cope in front of mullions if thresholds project beyond door faces.
4. Furnish with non-ferrous Stainless Steel Screws and Lead Anchors.
   a. National Guard as listed in sets
   b. Equal of Zero or Reese

N. Door Sweeps:

1. Surface Sweeps:
   a. National Guard as listed in sets
   b. Equal by Zero or Reese

O. Miscellaneous:

1. Furnish items not categorized in the above descriptions but specified by manufacturer's names in Hardware Sets.

P. Fasteners:

1. Furnish fasteners of the proper type, size, quantity and finish. Use machine screws and expansion shields for attaching hardware to concrete or masonry, and wall grip inserts at hollow wall construction. Furnish machine screws for attachment to reinforced hollow metal doors and frames and reinforced aluminum doors and frames. Furnish full thread wood screws for attachment to solid wood doors and frames. "TEK" type screws are not acceptable.
2. **Sex bolts will not be permitted on reinforced metal doors or wood doors where blocking is specified.**

2.3 Finishes:

A. Generally, Dull Chrome, US26D / BHMA 626. Provide finish for each item as indicated in sets.

2.4 Templates and Hardware Location:

A. Furnish hardware made to template. Supply required templates and hardware locations to the door and frame manufacturers.

B. Furnish metal template to frame/door supplier for continuous hinge.

C. Refer to Article 3.1 B.2, Locations, and coordinate with templates.

2.5 Cylinders and Keying:

A. All cylinders for this project will be supplied by one supplier regardless of door type and location.

B. The Finish Hardware supplier will meet with Architect and/or Owner to finalize keying requirements and obtain keying instructions in writing.
   1. Supplier shall include the cost of this service in his proposal.

C. Provide a cylinder for all hardware components capable of being locked.

D. Provide cylinders master and grand master keyed to existing system according to Owner's instructions. Provide change keys, master keys and grand master keys as required by Owner.

E. Provide cylinders with construction cores or keying for use during the construction period. When so directed, and in the presence of the Owner's security department or representative, convert construction cores or keying to the final system.
   1. Supplier shall include the cost of this service in his proposal.

PART 3 - EXECUTION

3.1 Installation

A. General:

1. Install hardware according to manufacturers installations and template dimensions. Attach all items of finish hardware to doors, frames, walls, etc. with fasteners furnished and required by the manufacture of the item.
2. Provide blocking/reinforcement for all wall mounted Hardware.
3. Reinforced hollow metal doors and frames and reinforced aluminum door and frames will be drilled and tapped for machine screws.
4. Solid wood doors and frames: full thread wood screws. Drill pilot holes before inserting screws.
5. Continuous gear hinges attached to hollow metal doors and frames and aluminum doors and frames: 12-24 x 1/2" #3 Phillips Keenform self-tapping. Use #13 or 3/16 drill for pilot.
6. Continuous Gear Hinges require continuous mortar guards of foam or cardboard 1/2" thick x frame height, applied with construction adhesive.
7. Install weather-strip gasket prior to parallel arm closer bracket, rim exit device or any stop mounted hardware. Gasket to provide a continuous seal around perimeter of door opening. Allow for gasket when installing finish hardware. Door closers will require special templating. Exit devices will require adjustment in backset.

B. Locations:

1. Dimensions are from finish floor to center line of items.
2. Include this list in Hardware Schedule.

CATEGORY	DIMENSION
Hinges	Door Manufacturer's Standard
Flush Bolt Levers	72" and 12"
Levers	Door Manufacturer's Standard
Exit Device Touchbar	Per Template
Wall Stops/Holders	At Head

C. Field Quality Inspection:

1. Inspect material furnished, its installation and adjustment, and instruct the Owner's personnel in adjustment, care and maintenance of hardware.
2. Locksets and exit devices shall be inspected after installation and after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
3. Closers shall be inspected and adjusted after the HVAC system is in operation and balanced, to insure correct installation and proper operation.

4. A written report stating compliance, and also locations and kinds of noncompliance shall be forwarded to the Architect with copies to the Contractor, hardware distributor, hardware installer and building owner.

D. Technical and Warranty Information:

1. At the completion of the project, the technical and warranty information coalesced and kept on file by the General Contractor/Construction Manager shall be given to the Owner or Owner's Agent. In addition to both the technical and warranty information, all factory order acknowledgement numbers supplied to the General Contractor/Construction Manager during the construction period shall be given to the Owner or Owner's Agent. The warranty information and factory order acknowledgement numbers shall serve to both expedite and properly execute any warranty work that may be required on the various hardware items supplied on the project.
2. Submit to General Contractor/Construction Manager, two copies each of parts and service manuals and two each of any special installation or adjustment tools. Include for locksets, exit devices, door closers and any electrical products.

3.2 Hardware Sets:

HARDWARE SET NO. 01

EACH TO HAVE:

1	EA	TRIM	990-DT	626	VON
1	EA	TRIM	990-NL-R	626	VON
			* BALANCE OF EXISTING HDWE TO REMAIN *		

HARDWARE SET NO. 02

EACH TO HAVE:

2	EA	HINGE	3CB1 4.5 X 4	600	IVE
4	EA	SPRING HINGE	3SP1 4.5 X 4	600	IVE
1	SET	CONST LATCHING BOLT	FB52	630	IVE
1	EA	STOREROOM LOCK	L9080L LLL 03A L283-150	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	

CYLINDER ONLY OUTSIDE, NO LEVER TRIM. COORDINATE HARDWRAE LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

HARDWARE SET NO. 03

EACH TO HAVE:

2	EA	CONT. HINGE	112HD	628	IVE
1	EA	KEYED REMOVABLE MULLION	KR4954-STAB	689	VON
1	EA	PANIC HARDWARE	98-DT	626	VON
1	EA	PANIC HARDWARE	98-NL	626	VON
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	RIM CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	WALL STOP	WS33X	626	IVE
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	MULLION SEAL	5100	BLK	NGP
2	EA	DOOR SWEEP	600A	CL	NGP
1	EA	THRESHOLD	425HD	AL	NGP

HARDWARE SET NO. 04

EACH TO HAVE:

1	EA	THRESHOLD	425HD * BALANCE OF EXISTING HDWE TO REMAIN *	AL	NGP

HARDWARE SET NO. 05

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE

HARDWARE SET NO. 06

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 03N L583-363	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	WALL STOP	WS33	626	IVE

HARDWARE SET NO. 07

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	98-DT	626	VON
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4021	689	LCN
1	EA	MOUNTING PLATE	4020-18G	689	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	CL	NGP
1	EA	THRESHOLD	425HD	AL	NGP

HARDWARE SET NO. 08

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	98-NL	626	VON
1	EA	RIM CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	OH STOP	100SE	630	GLY
1	EA	AUTO OPERATOR	(RE-USE EXISTING)		
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	CL	NGP
1	EA	THRESHOLD	425HD	AL	NGP

COORDINATE RE-USE OF AUTOMATIC OPERATOR WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

HARDWARE SET NO. 09

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
1	EA	WALL STOP	WS33	626	IVE

HARDWARE SET NO. 10

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE

HARDWARE SET NO. 11

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071L 03N	626	SCH
2	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE

WHERE CONDITIONS ALLOW, PROVIDE 4111 EDA & WS33(X) IN LIEU OF 4111 SCUSH. ALLOW MAXIMUM DEGREE OF OPENING WITH EITHER APPLICATION.

HARDWARE SET NO. 12

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	FB52	630	IVE
1	EA	STOREROOM LOCK	L9080L 03N	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	OH STOP	90S	630	GLY
2	EA	SURFACE CLOSER	4011	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE

HARDWARE SET NO. 13

EACH TO HAVE:

2	EA	CONT. HINGE	224HD	628	IVE
1	SET	CONST LATCHING BOLT	FB52	630	IVE
1	EA	STOREROOM LOCK	L9080L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN

HARDWARE SET NO. 14

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-03-SNB	626	VON
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
1	EA	WALL STOP	WS33X	626	IVE

HARDWARE SET NO. 15

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-03-SNB	626	VON
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE

HARDWARE SET NO. 16

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 03N L583-363	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE

WHERE CONDITIONS ALLOW, PROVIDE 4111 EDA & WS33(X) IN LIEU OF 4111 SCUSH. ALLOW MAXIMUM DEGREE OF OPENING WITH EITHER APPLICATION.

HARDWARE SET NO. 17

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	DUMMY PUSH BAR	350	626	VON
1	EA	TRIM	696-DT	626	VON
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4021	689	LCN
1	EA	MOUNTING PLATE	4020-18G	689	LCN

HARDWARE SET NO. 18

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	DUMMY PUSH BAR	350	626	VON
1	EA	TRIM	696-DT	626	VON
1	EA	SURFACE CLOSER	4021	689	LCN
1	EA	MOUNTING PLATE	4020-18G	689	LCN
1	EA	WALL STOP	WS33X	626	IVE

HARDWARE SET NO. 19

EACH TO HAVE:

3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE

HARDWARE SET NO. 20

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	FB52	630	IVE
1	EA	CLASSROOM LOCK	L9070L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
2	EA	OH STOP	450S	630	GLY

HARDWARE SET NO. 21

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	710	IVE
1	EA	PANIC HARDWARE	98-NL-OP-110MD	313	VON
1	EA	RIM CYLINDER	(MATCH EXISTING SYSTEM)	613	
1	EA	CONCEALED PULL	(BY DOOR MFR)		
1	EA	SURFACE CLOSER	4111 SCUSH	695	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600	DKB	NGP
1	EA	THRESHOLD	425HD	DKB	NGP

HARDWARE SET NO. 22

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	98-NL	626	VON
1	EA	RIM CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4021	689	LCN
1	EA	MOUNTING PLATE	4020-18G	689	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	CL	NGP
1	EA	THRESHOLD	425HD	AL	NGP

HARDWARE SET NO. 23

EACH TO HAVE:

8	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	KEYED FIRE RATED REMOVABLE MULLION	KR9954	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-03-SNB	626	VON
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
2	EA	RIM CYLINDER	(MATCH EXISTING SYSTEM)	626	
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE

HARDWARE SET NO. 24

EACH TO HAVE:

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-03-SNB	626	VON
1	EA	RIM CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
1	EA	WALL STOP	WS33	626	IVE

HARDWARE SET NO. 25

EACH TO HAVE:

2	EA	CONT. HINGE	112HD	710	IVE
1	EA	KEYED REMOVABLE MULLION	KR4954-STAB	695	VON
2	EA	PANIC HARDWARE	98-EO	313	VON
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	613	
2	EA	CONCEALED PULL	(BY DOOR MFR)		
2	EA	SURFACE CLOSER	4111 SCUSH	695	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	MULLION SEAL	5100	BLK	NGP
2	EA	DOOR SWEEP	600	DKB	NGP
1	EA	THRESHOLD	425HD	DKB	NGP

HARDWARE SET NO. 26

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 03N L583-363	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	OH STOP	450S	630	GLY

HARDWARE SET NO. 27

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	OH STOP	450S	630	GLY

HARDWARE SET NO. 28

EACH TO HAVE:

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
1	EA	WALL STOP	WS33	626	IVE

HARDWARE SET NO. 29

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DBL CYL STORE W/DB	L9466L 03N	626	SCH
2	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	WALL STOP	WS33	626	IVE

HARDWARE SET NO. 30

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
1	EA	WALL STOP	WS33	626	IVE

HARDWARE SET NO. 31

EACH TO HAVE:

1	EA	STOREROOM LOCK	LV9080L 03N	626	SCH
1	EA	MORTISE CYLINDER	(MATCH EXISTING SYSTEM)	626	
			* BALANCE OF HDWE BY DOOR SUPPLIER *		

END OF SECTION

SECTION 08 8000 – GLAZING (GLASS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified.

1. Windows.
2. Doors.
3. Glazed entrance storefronts.
4. Interior borrowed lites.
5. Glass Types (Locations are indicated in the Drawings).

B. Related Sections include the following:

1. Division 07 2100 Section “Thermal Insulation” at curtain-wall spandrel areas.
2. Division 07 8413 Section “Penetration Firestopping” at perimeter floor areas.
3. Division 07 9200 Section “Joint Sealants”.

1.3 DEFINITIONS

A. Glass Manufacturer: A firm that develops and produces glass from their factory.

B. Glass Fabricator: A company that fabricates glass purchased from a Glass Manufacturer.

C. Deterioration of Coated Glass: Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. Deterioration of Laminated Glass: Defects include edge separation, delamination materially obstructing vision through glass, and blemishes.

E. Deterioration of Insulating Glass: Failure of the hermetic seal. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed, heat-treated or tempered) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   a. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.
   b. Limit glass deflection to L/240 or flex use limit of glass, whichever is less, with full recovery of glazing materials.
   c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   d. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 3/4 inch (19 mm), whichever is less.

      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
      3) For laminated-glass lites.

   e. Minimum Glass Thickness for Exterior Lites: Not less than ¼ inch (6 mm).
   f. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

2. Safety and Fire-rated glass shall comply with CPSC – 16 CFR 1201 safety standards.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Glass Wind Load Design: 25 psf (1196 mm) minimum or higher to comply with exterior wall and roof design loads indicated. Comply with criteria of Governing Authorities and Agencies having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.

1. The name of the glass manufacturer and all technical data shall be included on the glass sample.
2. The name of the glass fabricator or supplier shall be included on the glass sample.
3. For each type of glass provided on the project. Refer to glazing glass types.
4. For each color of exposed glazing sealant.

C. Glazing Schedule: Use same designations indicated on Drawings or Specifications for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners.

F. Product Data on Glass Types: Provide manufacturer's structural, physical and environmental characteristics, size limitations and installation requirements.

G. SWRI Validation Certificate: For each elastomeric glazing sealant specified to be validated by SWRI's Sealant Validation Program.

H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: An experienced firm with at least five (5) years in business who has completed glazing similar in material, design, and extent to this Project; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program and acceptable to the glass manufacturer.

B. Source Limitations for Glass Types: Obtain glass from one primary-glass manufacturer for each glass type listed.

C. Adhesion and Compatibility Testing: Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

1. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

D. Glazing Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

E. Glazing Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

F. Safety Glazing Products: Comply with testing requirements of CPSC in 16 CFR 1201 and for CPSC CAT-1 and CPSC CAT-11.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.

2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

3. Glazing Requirements: Comply with all Rules and Standards for Safety Glazing of the current Michigan Construction Code and other agencies and authorities having jurisdiction.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below.

1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."

2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."

3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

H. Mockups (In-place): Before glazing, build mockups for each glass product indicated below to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Construct mockups in the exterior building wall at the location and size indicated as directed by Architect.

2. Build mockups with the following kinds of glass to match glazing systems required for Project, including typical lite size, framing systems, and glazing methods for Architect’s review before proceeding with general installation:

a. Insulated and spandrel glass.

3. Obtain Architect's acceptance of mockups before proceeding with construction.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 3100 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty on Coated-Glass Products: Written Warranty, made out to Owner and signed by coated-glass manufacturer agreeing to remove existing and furnish and install replacements for those coated-glass units that are deteriorated.

1. Warranty Period: ten (10) years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Laminated and Tempered Glass: Written warranty, made out to Owner and signed by glass manufacturer agreeing to remove existing and furnish and install replacements for glass units that deteriorate as defined in "Definitions" Article.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

D. Manufacturer's Special Warranty on Insulating Glass: Written Warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to remove existing and furnish and install replacements for insulating-glass units that deteriorate as defined in "Definitions" Article.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass Manufacturers – General

1. Obtain materials from only one manufacturer or fabricator for each type; obtain tinted primary glass (if any) used for each type from only one manufacturer.
2. Where manufacturer’s product names are indicated, only comparable products of the manufacturers listed as the Basis of Design will be considered.

B. Glass Manufacturers

1. Glass Products: The following listed glass manufacturers, provided they comply with the requirements of the contract documents, will be among the firms considered acceptable: Substitutions of other non-listed glass manufacturers will not be permitted.

a. Oldcaste

b. AFG Industries
c. Guardian Industries
d. PPG Industries, Inc.
e. Pilkington
f. Visteon
f. Vetrotech Saint-Gobain
g. Cardinal Industries Corp.

h. Paragon Architectural Products.

C. Glass Fabricators

1. Obtain materials from only one manufacturer or fabricator for each type; obtain tinted primary glass (if any) used for each type from only one manufacturer.
2. Where manufacturer's product names are indicated, comparable products of the glass manufacturers listed as the Basis of Design will be considered.

   a. Spec-temp / Atwood Inc.
   b. Oldcastle Glass Group
   c. PDC Glass of Michigan
   d. SAFTI, a division of O'Keeffe's Inc.
   e. Viracon
   f. Vetrotech Saint-Gobain
   g. Other glass fabricators in continuous business at least ten (10) years. Submit "Substitution Request" on form located in Specification Division 01 6000 Section "Product Requirements" to the Architect for evaluation.

D. Glass types: General Information

1. Not all glass types indicated here-in will be used on the project. Refer to the Drawings for applicable glass types to be provided.
2. Provide glass to comply with Building Codes and other Authorities and Agencies having jurisdiction.
3. Notify Architect of any conflicts. Glass fire-ratings shall be the same fire-rating as for the door or wall partitions indicated on the Drawings.
4. Glass Type for Skylights: Glass criteria and data is indicated in the Specification Sections 08 6300 "Metal-Framed Skylights."

E. GLASS TYPES

Note: Not all glass types indicated here-in will be used on the project. Refer to the Drawings for applicable glass types to be provided.

Note: Provide glass to comply with Building Codes and other Agencies having jurisdiction.

Note: Notify Architect of any conflicts. Glass fire-ratings shall be the same fire-rating as for the door or wall partitions indicated on the Drawings.

GL-1 ¼ inch thick Clear Tempered (FT) Glass
Fully-Tempered glass – Safety glass

GL-5a 1/2 inch thick clear glass
45 minute door and window applications
Must comply with CPSC Category 2
Impact Safety-Rated and Fire-Rated glass
Basis of Design: Superlite II-XL by Safti First
Maximum lite area = 4,952 square inches.

GL-10 1" Insulated Clear Fully-Tempered (FT) Glass Unit – Clear glass
1" Total thickness; Double pane with silicone sealant edge seal.
Exterior pane: ¼" thick, Clear, Fully-Tempered

Low-E (transparent coating) (locate on # 2 surface)
½" Air space
Interior pane: ¼" thick, Clear, Fully-Tempered
Visible light; % transmittance- 68
Shading coefficient- 0.44
Winter U-value – 0.33
Summer U-value – 0.33
Manufacturer (Basis of Design); Guardian Industries- Clear, SN-68 or Viracon VE 1-2M or PPG Solarban 60 (2) Clear.

GL-20 Basis of Design: Laminators Thermalite panel. 1" overall.
Face sheet of .032 aluminum (smooth)
Stabilizer- corrugated polyalimer composite.
Insulation- Isocyanurate
Interior sheet of .032 embossed aluminum
Finish to be manufacturers Kynar 500 colors (Ascot White) with 20 year finish warranty.

NOTE: The Glass Contractor shall provide and install the spandrel panels as part their intregal responsibility.
Other manufacturers must match laminators Inc. colors

1. Mapes Corelite Panels
2. Citadel Architectural, GlazeGuard 1000 WR. ** Statre Corp. (248-307-0800).

2.2 ELASTOMERIC GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of custom and special colors.

B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

2.3 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers, and complying with ASTM C 1281 and AAMA 800.

B. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.

2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
3. Thermoplastic polyolefin rubber.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

3.2 PREPARATION

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

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials.

B. Glazing channel dimensions, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove imperfections and damaged glass from Project site and legally dispose of off Project site.

D. Apply primers to joint surfaces where required for adhesion of sealants.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass-lites where the length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where needed to prevent glass-lites from moving sideways in glazing channel.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Compress gaskets to produce a weather-tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. Remove them immediately as recommended by glass manufacturer.

C. Promptly remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 08 8000

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to coordination of metal stud spacing for curved wall and other partition types and the following:

1. Steel suspended ceiling and soffit framing.
2. Steel partition framing.
3. Interior gypsum wallboard.
4. Exterior gypsum board panels for ceilings and soffits.
5. Tile backing panels.
6. Trim accessories.
7. Joint Sealants.

B. Related Sections include the following:

1. Division 05 4000 Section “Cold-Formed Metal Framing" for load-bearing steel framing.
2. Division 06 1000 Section "Rough Carpentry" for wood framing and furring.
3. Division 07 2100 Section "Thermal Insulation" for insulation and vapor retarders installed in gypsum board assemblies.
4. Division 07 8413 Section “Penetration Fire-Stopping and Smoke System.”
5. Division 09 3000 Section "Tiling" for cementitious backer units installed as substrates for ceramic type tile materials.
6. Division 09 9100 Section “Painting” for primers applied to gypsum board surfaces.

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

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

B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to

ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products", UL's "Fire Resistance Directory", GA-600, "Fire Resistance Design Manual."

B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

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. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Framing and Furring:

a. Clark Steel Framing Systems.
b. Dale Industries, Inc. - Dale/Incor.
c. Dietrich Industries, Inc.
d. National Gypsum Company.
e. Unimast, Inc.
f. Western Metal Lath & Steel Framing Systems.

2. Gypsum Board and Related Products:

a. American Gypsum Co.
b. G-P Gypsum Corp.
c. Lafarge North America Inc.
d. National Gypsum Company.
e. United States Gypsum Co. (USG Corp.)

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

C. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to five (5) times that imposed by construction as determined by testing according to ASTM E 488.
2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to ten (10) times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

D. Hangers: As follows:

1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, minimum 0.162-inch (4.12-mm) diameter.
2. Rod Hangers: ASTM A 510 (ASTM A 510M), galvanized mild carbon steel.
3. Flat Hangers: Commercial-steel sheet, ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized or ASTM A 366/A 366M, with corrosion-resistant paint finish.
4. Angle Hangers: ASTM A 653/A 653M, [**G60 (Z180)**], hot-dip galvanized commercial-steel sheet, sized to structurally support materials.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized manufacturer's standard corrosion-resistant zinc coating.

1. Depth: 2-1/2 inches (63.5 mm) unless otherwise indicated.

F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized manufacturer's standard corrosion-resistant zinc coating.

1. Cold Rolled Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, 3/4 inch (19.1 mm) deep.
2. Steel Studs: ASTM C 645.
   a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
   b. Depth: 3-5/8 inches (92.1 mm) unless otherwise indicated.
3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
   a. Interior Locations - Minimum Base Metal Thickness: 0.0312 inch (0.79 mm) unless otherwise indicated.
   b. Exterior Locations: Install 18 ga. Minimum light-gauge metal stud type and bracings not more than 4'-0" apart to resist 25 lbs./sf for wind up-lift.
4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.

G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
b. Chicago Metallic Corporation; Fire Front 630 Drywall Furring 640 System.
c. USG Interiors, Inc.; Drywall Suspension System.

2.3 STEEL PARTITION FRAMING

A. Components, General: Refer to Section 05 4000 “Cold-Formed Metal Framing” and as follows:

1. Comply with ASTM C 754 for conditions indicated.
2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized manufacturer's standard corrosion-resistant zinc coating.

B. Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
2. Depth: 3-5/8 inches (92.1 mm) unless otherwise indicated.
3. Exterior Locations: 18 gauge Minimum light gauge steel studs.

C. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges.

D. Proprietary Deflection Track for Non-Rated Partitions: Steel sheet top runner manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above; in thickness indicated for studs and in width to accommodate depth of studs.

1. Product: Subject to compliance with requirements, provide one of the following:

a. Delta Star, Inc., Superior Metal Trim; Superior Flex Track System (SFT).
b. Metal-Lite, Inc.; Slotted Track.

E. Proprietary Firestop Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Product: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
b. Metal-Lite, Inc.;The System.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm) unless otherwise required.

G. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange.

1. Depth: 1-1/2 inches (38.1 mm) minimum.
2. Clip Angle: 1-1/2 by 1-1/2 inch (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Interior Locations: Minimum Base Metal Thickness: 0.0312 inch (0.79 mm) at interior locations and 0.0428 at exterior locations.
2. Depth: 7/8 inch (22.2 mm) unless otherwise indicated.
3. Exterior Locations: 18 gauge Minimum light gauge steel studs.

I. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.

J. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange.

1. Depth: 3/4 inch (19.1 mm) minimum.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

L. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

M. Install horizontal bracing at 8’-0” on center maximum vertical spacing along entire height of partitions type forming construction.

2.4 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

1. Joint Locations: Provide joints at transitions, at one side of openings and at not more than 30 feet along walls and ceilings and elsewhere, where indicated on Drawings. Coordinate and review with the Architect. Provide joint accessories.

B. Gypsum Wallboard: ASTM C 36.

1. Regular Type:

a. Thickness: 5/8 inch, unless otherwise indicated.
b. Long Edges: Tapered.
c. Locations: Regular partition types.

2. Fire Rated
a. Refer to drawings for fire rated wall and assembly locations. Provide 5/8” fire rated gypsum wallboard as required to achieve fire ratings indicated.

3. Types C and X:

a. Thickness: 5/8 inch (15.9 mm) unless otherwise indicated.
b. Long Edges: Tapered.
c. Locations: As indicated and where required for fire-resistance-rated assembly.

C. Ceiling Type Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch (12.7 mm) minimum, unless otherwise indicated.
2. Long Edges: Tapered.
3. Locations: Ceiling surfaces.

D. Proprietary Abuse-Resistant Gypsum Wallboard: ASTM C 36, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. National Gypsum Company; Gold Bond Hi-Abuse Wallboard.
b. United States Gypsum Co.; SHEETROCK Brand Abuse-Resistant Gypsum Panels.
c. Other Manufacturer's equal product, acceptable to the Architect.

2. Location: Bottom 48" of all interior wall surfaces to be 5/8" abuse resistant gypsum wallboard.

3. Core: 5/8 inch (15.9 mm), Abuse-resistant Type X.
4. Long Edges: Tapered.
5. Locations: Where indicated.

2.5 EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

1. Joint Locations: Provide joints at transitions, at one side of openings and at not more than 15 feet along walls and ceilings and elsewhere, where indicated on Drawings. Coordinate and review with the Architect. Provide joint accessories.

B. Exterior Gypsum Soffit Board: ASTM C 931/C 931M, with manufacturer's standard edges.

1. Core: As indicated, 1/2 inch (12.7 mm), regular type and 5/8 inch (15.9 mm), Type X.

C. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Dens-Glass Gold" by G-P Gypsum Corp.
2. Core: As indicated, 1/2 inch (12.7 mm), regular type and 5/8 inch (15.9 mm), Type X.

2.6 TILE BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.

1. Core: 5/8 inch (15.9 mm), Type X.

C. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M.

1. Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.
2. Core: 5/8 inch (15.9 mm), Type X.

D. Cementitious Backer Units: ANSI A118.9.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Custom Building Products; Wonderboard.
   b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   c. United States Gypsum Co.; DUROCK Cement Board.

2. Thickness: As indicated.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

   a. Cornerbead: Use at outside corners.
   b. Bullnose Bead: Use where indicated.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
   d. L-Bead: L-shaped; exposed long leg receives joint compound; use where required.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges.
   f. Expansion (Control) Joint: Use where indicated and required.
   g. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet or rolled zinc.
2. Shapes:

   a. Cornerbead: Use at outside corners.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
   c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. Use where indicated and required.
   d. Expansion Joint Unit: Install where indicated.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fry Reglet Corp.
   b. Gordon, Inc.
   c. MM Systems Corporation.

d. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified or Class II anodic finishes and factory-painted, baked-enamel finishes.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
3. Cementitious Backer Units: As recommended by manufacturer.

2.9 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
c. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
d. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant.

2.10 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

G. Polyethylene Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

H. Fire-Safing Insulation: As specified in Division 07 Section “Thermal Insulation.” For fire-rated partitions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building

structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

1. Furnish concrete inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

a. Use deep-leg deflection track.
b. Use proprietary deflection track.
c. Use proprietary firestop track.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.

4. Secure rod flat angle hangers to structure, including intermediate framing members, by attaching to inserts, eye-screws, or other devices and fasteners that are secure and

appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within **1/8 inch in 12 feet (3 mm in 3.6 m)** measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. For exterior soffits, install cross bracing and framing to resist wind uplift.

E. Screw furring to wood framing.

F. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

G. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.

1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

H. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the 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.

1. Cut studs 1/2 inch (13 mm) short of full height to provide perimeter relief.
2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring at the following spacings:

1. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
2. Multilayer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
3. Cementitious Backer Units: 16 inches (406 mm) o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

H. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
4. Until gypsum board is installed, hold insulation in place with 10-inch (250-mm) staples fabricated from 0.0625-inch- (1.59-mm-) diameter, tie wire and inserted through slot in web of member.

I. Vapor Retarder: Install to comply with requirements specified in Division 07 Section” Thermal Insulation."

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.

I. Control Joints and Expansion Joints: Install control and expansion joints at locations indicated on Drawings and according to ASTM C 840 and in locations acceptable to the Architect and to maintain fire-resistance rating of the assemblies and with space between edges of adjoining gypsum panels.

J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Fit gypsum panels around ducts, pipes, and conduits.
2. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

L. Floating Construction: Install gypsum panels over wood framing, with floating internal corner construction.

M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

O. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

3.7 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing**)**, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

E. Multilayer Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

F. Laminating to Substrate: Where gypsum panels are directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

G. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

H. Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
2. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, tubs, and locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
3. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and locations indicated to receive tile.
4. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
5. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, install control joints according to ASTM C 840 and in specific locations approved by Architect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level-1: Above finished ceilings concealed from view, ceiling plenum areas, and where indicated. Embed tape in joint compound, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies. Joint sanding not required.
2. Level-2: Areas that form substrate for Ceramic Tile or other hard surface materials. Embed tape in joint compound and apply separate first coat of joint compound to tape, fasteners, and trim flanges. Sand joints to substrate tolerances.
3. Level-4: Walls and Ceilings for Painting. Embed tape in joint compound and sand joints. Apply a separate finish coat of joint compound to tape, fasteners, and trim flanges. Sand joints and fastener areas for a smooth flat transition.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: General Contractor will conduct an above-ceiling observation and report deficiencies in the Work observed. Proceed with installation of gypsum board to ceiling support framing after deficiencies have been corrected.

1. Notify all Contractors seven (7) calendar days in advance of date and time when Project, will be ready for above-ceiling observation.

END OF SECTION 09 2900

SECTION 09 3000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to the following:

1. Ceramic and porcelain tile.
2. Waterproof membrane for thin-set tile installations.
3. Metal edge strips installed as part of tile installations.

B. Related Sections include the following:

1. Division 02 4119 Section “Selective Structure Demolition” for removing existing items and finishes.
2. Division 03 3000 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
3. Division 07 9200 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
4. Division 09 2900 Section "Gypsum Board" for cementitious backer units and glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

1.5 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.

D. Product Certificates: For each type of product, signed by product manufacturer.

E. Qualification Data: For Installer with at least three (3) years in business.

F. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

A. Source Limitations for Materials and Products: Obtain products specified in this Section through one source from a single manufacturer:

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish two (2) full cartons or approximately 50 Sq. Ft. of each type and color installed on the project.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

A. Where titles below introduce lists, the following requirements apply for product selection:

1. Manufacturer's Product. Basis-of-Design – Product is as indicated in the Drawings. Subject to compliance with requirements, provide the named product. Comparable products by other manufacturers must be approved by the Architect prior to bids being received. Alternate manfacturers will not be approved after bids are received.

   a. American Olean; Div. Of Dal-Tile International Corp.
   b. Crossville Ceramics Company, L.P
   c. Daltile; Div. Of Dal-Tile International Inc.

G. Ceramic, Porcelain and Quarry Tile Types

1. Refer to Schedules information located in the Architects Drawings.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As selected by Architect from manufacturer's full range of products.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation **in swimming pools**, **on exteriors or in wet areas**, **do not use back- or edge-mounted tile assemblies** unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 THRESHOLDS AND WINDOW SILLS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch (12.7 mm) or less, and finish bevel to match face of threshold.

C. Manufactured, Solid Polymer Thresholds and Sills: Made from homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without precoated finish.

1. Contractor's Option: Matching marble threshold and sills specifications.

2. Manufacturers:

a. Avonite, Inc.
b. DuPont Polymers.
c. Formica Corporation.
d. Nevamar; International Paper; Decorative Products Division.
e. Swan Corporation (The).
f. Wilsonart International; Div. of Premark International, Inc.

2.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10.

1. Manufacturer's Product – Basis of Design: Provide and install "Schluter-Ditra" polyethylene membrane or accepted equal to suit location areas indicated.
2. Manufacturer's standard expansion/control and movement joints, accessories compatible with tile material installed.

B. Polyethylene-Sheet Product: Polyethylene faced on both sides with fleece webbing for adhering to latex-portland cement mortar; 39 inches (1000 mm) wide by 0.008-inch (0.203-mm) nominal thickness.

C. Fabric-Reinforced, Modified-Bituminous-Sheet Product: Self-adhering SBS-modified-bituminous sheet with woven reinforcement facing for adhering to latex-portland cement mortar; 36 inches (914 mm) wide by 0.040-inch (1.01-mm) nominal thickness.

D. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement.

E. Urethane Waterproofing and Tile-Setting Adhesive: One-part liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

F. Waterproofing membranes in a consistency suitable for trowel application and intended for use as waterproofing.

1. Products:

a. Boiardi Products Corporation; Elastiment.
b. Custom Building Products; LevelQuick Waterproofing and Anti-Fracture Membrane.
c. Jamo Inc.; Waterproof.
d. The Noble Company; under-layment systems.

G. Control Joint Locations: Comply with The Tile Council of America (TCA) and where indicated.

1. Interior Locations (Horizontal and Vertical):

   a. Expansion, control, construction joints – 24 feet to 36 feet in each direction.
   b. Expansion joints - 8 feet to 12 feet where Tile work is located in direct sunlight or moisture locations.
   c. Coordinate joint locations with Architect and for other areas indicated or required.
   d. Joint width shall be 3/8 inch, unless otherwise indicated.
   e. Provide under-layment systems.
   f. Install compatible sealant and of color approved by the Architect.

2.5 SETTING AND GROUTING MATERIALS

A. Manufacturers accepted but not limited to the following:

1. Boiardi Products Corporation.
2. Bostik.
3. Custom Building Products.
4. Southern Grouts & Mortars, Inc.
5. TEC Specialty Products Inc.

F. Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

G. Water-Cleanable, Tile-Setting Epoxy Adhesive: ANSI A118.3.

H. Chemical-Resistant Furan Mortar: ANSI A118.5, with carbon filler, unless otherwise indicated.

I. Organic Adhesive: ANSI A136.1, Type I.

J. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

2.6 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing ceramic tile joints and other nonporous substrates that are subject to high humidity and extreme temperatures.

1. Products:

   a. Dow Corning Corporation; Dow Corning 786.
   b. GE Silicones; Sanitary 1700.

c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
d. Tremco, Inc.; Tremsil 600 White.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

1. Products:

a. Bostik; Chem-Calk 550.
b. Pecora Corporation; NR-200 Urexpan.
c. Tremco, Inc.; THC-900.

2.7 CEMENTITIOUS BACKER BOARDS

A. Provide cementitious backer boards complying with ANSI A118.9 in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: 1/2 inch (12.7 mm), if not indicated otherwise, manufacturer's standard thickness.

B. Products:

1. C-Cure; C-Cure Board 990.
2. Custom Building Products; Wonderboard.
3. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
4. USG Corporation; DUROCK Cement Board.
5. Densglas.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Under-layments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, **stainless steel; ASTM A 666, 300 Series** exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with adhesives or thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion and Control Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.

2. Install Crack-Suppression Membrane on substrates.
3. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-Portland cement; dry-set, commercial Portland cement; and latex-Portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.
3. For chemical-resistant furan grouts, comply with ANSI A108.8.

H. Install Epoxy Grout at all locations.

I. Install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-suppression membrane over substrate to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).
2. Quarry Tile: 1/4 inch (6.35 mm).
3. Paver Tile: 1/4 inch (6.35 mm).

D. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

E. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Install gypsum lath or metal lath and scratch coat for walls to comply with ANSI A108.

C. Joint Widths: Install tile on walls with the following joint widths:

1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).
2. Glazed Wall Tile: 1/8 inch (3.2 mm).
3. Quarry Tile: ¼ inch (6.35 mm).

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

END OF SECTION 09 3000

SECTION 09 5123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes acoustical tiles for ceilings and the following:

1. Exposed suspension systems.
2. Trim and Accessories
3. Acoustic ceiling tile types.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Suspension System Members: 12-inch- (300-mm-) long Sample of each type.
3. Exposed Moldings and Trim: Set of 12-inch- (300-mm-) long Samples of each type and color.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.

E. Research/Evaluation Reports: For acoustical tile ceiling and components and anchor type.

F. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class-A materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.
b. Maximum Flame Spread: 25

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 3100 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Within each space to receive specified products, do not begin installation until the following conditions are met:

1. Work above ceilings has been finished, tested, and approved.

2. Space to receive ceiling system is properly enclosed and protected from weather.
3. Any wet work within the space is dry.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Manufacturers as indicated on the Drawings and as listed below.

1. Armstrong World Industries, Inc.
2. Celotex Corp. (The)
3. USG Interiors, Inc.

2.2 ACOUSTICAL TILES, GENERAL

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances.

B. Coating-Based Antimicrobial Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273.

C. AT1- AT-5 See drawings for specific tile information.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung."

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung").

E. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICALTILE CEILING

A. Manufacturer's Products: Basis of Design: USG DXL 15/16" Exposed Tee System
1. Locations: With AT1 -2
2. Include hemmed edge moldings and accessories.
3. Color: White (or Wood – see drawings)
4. For AT3-5 Provide 4", 6" or 12" high fascia molding around all exposed suspended ceiling areas.

2.5 MISCELLANEOUS MATERIALS

A. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.

B. Staples: Divergent-point staples and as directed by the Acoustic Tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.

3.2 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical tile ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired.

END OF SECTION 09 5123

SECTION 09 6467 - WOOD FLOOR REFINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Patching and refinishing existing wood athletic floors

1.3 SUBMITTALS

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

1.4 REFERENCES

A. DIN- Performance Standard DIN 18032, Part 2, 2001

B. MFMA- Maple Flooring Manufacturers Association

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed wood flooring refinishing similar in material, design, and extent to that indicated for this Project.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 3100 Section “Project Management and Coordination” for Project Meetings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood-flooring materials in protected, unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood-flooring materials in a dry, warm, well-ventilated, weather-tight location.

D. Move wood flooring into spaces where it will be installed at least seven days before installation.

1.7 PROJECT CONDITIONS

A. Conditioning: Maintain relative humidity conditions planned for building occupants, but not greater or less than the relative humidity range recommended by MFMA, and an ambient temperature between 55 and 75 deg F (13 and 24 deg C) in spaces to receive wood flooring for at least seven days before installation, during installation, and for at least seven days after installation. After postinstallation period, maintain relative humidity conditions and ambient temperature planned for building occupants.

1. Open sealed packages to allow wood flooring to acclimatize.
2. Do not install flooring until it adjusts to the relative humidity of and is at the same temperature as the space where it is to be installed.
3. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by flooring and finish manufacturer, but not less than 10 days.

PART 2 - PRODUCTS

2.1 FINISHING MATERIALS

A. Floor-Finish System: MFMA-listed system of compatible components recommended by flooring and finish manufacturers for application indicated.

1. Type: Group 2, Heavy Duty Finishes; urethane-oil type.
2. Type: Group 3, Gymnasium Type (Surface) Finishes; urethane-oil type.
3. Type: Group 5, Water Based Finishes; polyurethane.
4. Floor Sealer: Pliable, penetrating type.
5. Finish Coats: Formulated for gloss finish and multicoat application.

B. Game-Line and Marker Paint: High-gloss enamel compatible with finish and recommended by finish and paint manufacturers for this purpose.

C. Stain: Inside 3 point line and outside the lane of the main basketball court. Apply 2 coats.
1. Semi-transparent Stain
   a. Manufacturer: Duraseal
   b. Product: Quick-Coat Penetrating Finish
   c. Shade name: Country white
   d. Density: 6.9-7.5 lbs/gal
   e. Viscosity: 22-65 centipoise
   f. % solids: 33-42%
   g. VOC: 550 grams/liter or 4.6 lbs/gal maximum
2. Preparation and application to apply with manufacturer’s instructions.

2.2 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils (0.15 mm) thick.

B. Asphalt Primer: ASTM D 41.

C. Asphalt Mastic: ASTM D 312, Type I, cold-applied dead-level asphalt or Type III, hot-applied steep asphalt, as recommended in writing by manufacturer.

D. Sleeper Shims: Hardboard in size and type recommended in writing by flooring manufacturer for application indicated.

E. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.

F. Wall Base: Molded, vented, rubber base; 4 by 3 by 48 inches (101 by 75 by 1219 mm); with pre-molded outside corners.

1. Color: As selected by Architect from manufacturer's full range of finishes.

PART 3 - EXECUTION

3.1 SANDING AND FINISHING

A. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.

B. Finish: Apply seal and finish coats of finish system according to manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.

1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and side bonding effect.
2. Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions. Mask flooring to provide sharp edges. Where game lines cross, break minor game line at intersection; do not overlap lines.

C. Sand and refinish wood base in Cafeteria.

3.2 PROTECTION

A. Protect wood flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 6466

SECTION 09 6519 – RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Vinyl composition tile (VCT).
   2. Resilient wall base and accessories.
   3. Resilient Floor and Base Types – For information, refer to Schedules located on Drawings.

1.3 SUBMITTALS

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

B. Drawings of floor pattern graphics, including dimensions and reference locations.

C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile, wall bases and accessories.

D. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

   1. 48 hours before and 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every fifty (50) boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Product – Basis-of-Design: Refer to drawings. Subject to compliance with requirements, provide the named product or a comparable product acceptable to the Architect by one of the other manufacturers listed.

B. Manufacturers as indicated on the Drawings and as listed below.

1. Armstrong World Industries, Inc.
2. Johnsonite, Inc.
3. Burke Mercer Flooring Products – Division Burke Industries.
4. Roppe Corporation.
5. Nora Rubber Flooring.
6. Marley

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.

1. Manufacturer Product – Basis of Design: Material Information and Selection.
   a. Refer to Schedules located in the Architect’s Drawings.

B. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.4 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.

1. Manufacturers Product – Basis of Design: Material Information and Selection. Refer to Schedules located in the Architect's Drawings.
2. Height: 4 inches nominal - typical.
3. Length: Coils.
4. Style: Standard cove base at tile and tile/carpet locations.
5. Corners (outside and inside): Provide prefabricated units matching base in color and finish. Required at all bullnosed corners.

2.5 RESILIENT MOLDING ACCESSORY

A. Description: Carpet edge for glue-down applications; Nosing for resilient floor covering; Reducer strip for resilient floor covering; Joiner for tile and carpet, unless otherwise noted on the Architect's Drawings.

1. Burke Mercer Flooring Products.
2. Johnsonite.
3. Marley
4. Roppe Corporation.

B. Material: Rubber.

2.6 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Install resilient products when they are same temperature as space where they are to be installed.

G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis unless otherwise indicated.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction unless otherwise indicated.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 RESILIENT ACCESSORY INSTALLATION

A. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

    a. Use commercially available product acceptable to manufacturer.
    b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09 6519

SECTION 09 6710 - EPOXY FLOORING

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 epoxy flooring systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: For each type of exposed finish required.

C. Material Test Reports: For each resinous flooring component.

D. Material Certificates: For each resinous flooring component, signed by manufacturer.

E. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying epoxy flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with epoxy flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 EPOXY FLOORING

A. Products: Subject to compliance with requirements, provide the following:
1. Sherwin Williams Decorative Mosaic Epoxy Coating System (20-30 mil thickness)
a. Seal Coat
b. Grout Coat
c. Broadcast
d. Base Coat
e. Primer
f. Pre-Primer/Tack Coat (Sherwin Williams General Polymer Floors GP5531 and GP3513 Epoxy Scratch Coat Mastic)
1) Use GP3513 to skim existing grout lines.

B. System Characteristics:

1. Color and Pattern: To be selected from General Polymers Decorative Mosaic Color Card.
2. Wearing Surface: Manufacturer's standard slip-resistant texture.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Existing Ceramic Tile Flooring:
1. Prep floor with light shot blast to Concrete Surface Profile (CSP) 3.
2. Install Epoxy Scratch Coat Mastic to skim existing grout lines
3. Install Pre-Primer/Tack Coat

C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as directed by manufacturer
   a. Shot blast and or diamond grind the concrete surface to a similar 60 grit textured surface or SP # 4.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates are dry.

   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
   c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

E. Use patching and fill material to fill holes and depressions in substrates with quick curing epoxy patch material and according to manufacturer's written instructions.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

G. Sweep and vacuum the entire surface to ensure clean substrate.

H. Wash down all surfaces to be covered with new flooring material according to manufacturer’s written recommendations.

3.2 APPLICATION

A. General: Apply components of epoxy flooring in accordance with manufacturer’s installation instructions.
   1. Fill all saw cut joints with flexible polyurea joint filler.
   2. Patch all cracks and divots with a quick cure epoxy patch material patch fill.
   3. Once cured grind smooth and clean all debris off the concrete floor surface before installation.
   4. Apply primer coat.
   5. Once cured apply base coat, while wet broadcast the desired color of multi colored chips as recommended by manufacturer.
   6. Once cured scrape the chips to a desired texture, clean all excess chips up before binder is applied.
   7. Apply a clear binder coat (grout coat).
   8. Once cured apply seal coat.
   9. During the entire application and curing process a temperature between 50 and 90 degrees Fahrenheit must be maintained.

3.3 CLEANING AND PROTECTING

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09671

SECTION 09 6816 – SHEET CARPETING AND TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Carpet tile.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Shop Drawings: Show the following:

   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
   2. Existing flooring materials to be removed.
   3. Existing flooring materials to remain.
   4. Carpet type, color.
   5. Seam locations, types, and methods.
   6. Type of installation.
   7. Pattern type, repeat size, location, direction, and starting point.
   8. Pile direction.
   9. Type, color, and location of insets and borders.
   10. Type, color, and location of edge, transition, and other accessory strips.
   11. Transition details to other flooring materials.
   12. Type of cushion.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

   1. Carpet: 12-inch- (300-mm-) square Sample.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance Data:

   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer in business at least five (5) years who is certified by the Floor Covering Installation Board.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an inspecting agency acceptable to authorities having jurisdiction.

C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 01 Section "Product Requirements" for Substitutions Requests.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 05, "Storage and Handling."

B. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping. Maintain temperature in storage area above 40° F.

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, loss of face fiber, edge raveling, snags, runs, and delamination.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-sized units equal to five percent (5%) of the amount of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS – CARPET TILE

A. Manufacturers Product – Basis of Design: The design for each material type is based on the product named. Subject to compliance with the requirements, provide the named product or a comparable product acceptable to the Architect by one of the other manufacturers.

   1. Carpet Tile Manufacturers as indicated on drawings.

B. Carpet Types – Material Information and Selection:

   1. C1- Style and color as indicated on drawings. Multi-level loop. 24” square carpet tile.

C. Performance Characteristics: As follows:

   1. Critical Radiant Flux Classification: Not less than 0.22 W/sq. cm.
   2. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
   3. Resistance to Insects: Comply with AATCC-24.
   4. Noise Reduction Coefficient (NRC): Per ASTM C 423.
   5. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165.
   6. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) per AATCC-16.
   7. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC-174.
   8. Electric static dissipation.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet manufacturer, carpet cushion manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by carpet manufacturer, carpet cushion manufacturer.

   1. Provide adhesives that comply with the content when tested according to ASTM D 5116.

C. Tackless Carpet Stripping: Water-resistant plywood in strips as required to match cushion thickness and that comply with CRI 104, Section 11.3.

D. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Install trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

3.3 INSTALLATION

A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation."

B. Double-Glue-Down Installation: Comply with CRI 104, Section 9, "Double Glue-Down Installation."

C. Carpet with Preapplied Adhesive Installation: Comply with CRI 104, Section 10.4, "Pre-Applied Adhesive Systems (Peel and Stick)."

D. Hook-and-Loop Installation: Comply with CRI 104, Section 10.5, "Hook and Loop Technology."

E. Stretch-in Installation: Comply with CRI 104, Section 11, "Stretch-in Installation."

F. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

1. Bevel adjoining border edges at seams with hand shears.
2. Level adjoining border edges.

G. Do not bridge building expansion joints with carpet.

H. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

I. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

K. Install pattern parallel to walls and borders, unless otherwise indicated.

L. Install carpet cushion seams at 90-degree angle with carpet seams.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 09 6816

SECTION 09 8400 – ACOUSTIC ROOM COMPONENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish a system of sound-absorbing and sound-diffusing acoustical panels of size and shapes shown for Wall Panels and Special Shapes as indicated on the Drawings.
   a. Band Rooms.

B. Products Furnished but not Installed under This Section:

1. Interactive acoustical panel system to be installed under provision of this Section.

C. Related Sections include but not limited to the following:

1. Division 05 4000 Section “Cold-Formed Metal Framing” for hanging and supports.

1.2 REFERENCES

1. ASTM International (ASTM):
   a. ASTM C 423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   b. ASTM C 612 – Specification for Mineral Fiber Block and Board Thermal Insulation.
   c. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   d. ASTM E 336 – Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.
   e. ASTM E 413 – Classification for Determination of Sound Transmission Class.
   f. ASTM E 795 – Practices for Mounting Test Specimens during Sound Absorption Tests.
2. Underwriters Laboratories, Inc.:
   a. UL 723 – Test For Surface Burning Characteristics of Building Materials.
3. National Fire Protection Association:
   a. NFPA 101 – Life Safety Code Requirements for Interior Finish.

1.3 PERFORMANCE REQUIREMENTS

A. Airborne Noise Reduction: Provide acoustical absorber and diffuser panels in layout designed by computer simulation based on Fitzroy formulas to provide the following sound reduction: Band Rehearsal: dB +/- 0.5dB.

B. Reverberation Time: Provide acoustical absorber and diffuser panels in layout designed by computer simulation based on Fitzroy formulas to provide the following reverberation times: Band Rehearsal: +/- 0.2 seconds.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in manufacture of acoustic room components.
   1. Manufacturers seeking approval must submit the following:
      a. **Acoustical analysis and** proposed layout for this project as described in Submittals Article above.
      b. Samples of each component of product specified, when requested by Architect.
      c. Project references: Minimum of 5 installations not less than 5 years old, with owner contact information.
      d. Sample warranty.
   2. Submit substitution request not less than 15 days prior to bid date.
   3. Approval will be indicated by issuance of written Addendum.
   4. Approved manufacturers must meet separate requirements of Submittals Article.

B. Fabric Fire-Test-Response Characteristics per ASTM E 84 or UL Standard 723: Flame spread index: 5 or less; Smoke developed index: 70 or less.

C. Source Limitations: Obtain the following products through one source from a single approved manufacturer in accordance with Division 01 Section "Special Project Procedures for Music Education Facilities":
   1. Acoustical room components.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle acoustical absorber and diffuser panels in accordance with panel and fabric manufacturers' recommendations. Ship to jobsite only after roughing-in, painting work, and other related finish work has been completed and installation areas are ready to accept units and recommended temperature and humidity levels will be maintained during the remainder of construction.

1.6 WARRANTY

A. Special Warranty: Manufacturer's written warranty indicating manufacturer’s intent to repair or replace acoustical absorber and diffuser panels that fail in materials or workmanship within 5 years from date of Substantial Completion. Failures are defined to include, but are not limited to, the following:
   1. Fracturing or breaking of unit components which results from normal wear and tear and normal use other than vandalism.
   2. Delamination or other failures of glue bond of components.
   3. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
   4. Failure of unit to perform acoustically in accordance with manufacturer's published data.

1.7 SUBMITTALS

A. Product Data: Manufacturer’s data sheets, installation instructions, and maintenance recommendations for each type of acoustical absorber and diffuser panel.
   1. Include data indicating coefficients of absorption and Sabines per unit for each type of panel used in the analysis and proposed design layout.

B. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency.

C. Shop Drawings: Prepared by manufacturer. Include elevations showing acoustic room components sizes, arrangements, and details of each condition of installation. Show fabrication and installation details.
   1. Indicate variations from basis of design unit sizes and layout shown on drawings, based upon performance of proposed products.
   2. Provide one computer generated engineering calculation and a graphic representation of each room's acoustical properties. Calculations will include expected loudness levels and reverberation times prior to installation of acoustical panels, and expected results after installation.
      a. Base calculations on proposed supplier's specific products.
      b. Indicate absorption and reverberation time properties complying with design requirements, utilizing octave band frequencies from 125 Hz to 4,000 Hz, based upon the Fitzroy formulas.
      c. Show room response at 125 to 4000 Hz octave bands empty, untreated and occupied, and treated and occupied.
      d. Calculations based upon NRC data alone do not meet the requirements of this specification.

1.11 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Acoustical absorber and diffuser panels design is based upon products of the manufacturer below:
Wenger Corporation, Owatonna, MN; Telephone: (800)887-7145; Attn: Maggie Kramer, Email: maggie.kramer@wenger.com; Website: www.wengercorp.com.

B. Other Manufacturers / Fabricators: Summit “Substitution Request” form on Architects’s form located in Division 01 6000 Section “Product Requirements.”

2.2 MATERIALS

A. Glass Fiber Board: ASTM C 612, Type 1A, 6 lb/cu. ft. (96 kg/cu. m) density molded rigid board, flame spread index 25 maximum, and smoke-developed index 450 maximum.

B. Thermoplastic Sheet: PVC acrylic plastic sheet, flame spread index 25 maximum, and smoke-developed index 450 maximum.

C. Fabric Facing Material: 100 percent woven plain weave polyester 2-ply, with the following characteristics:
Light Fastness: AATCC 16, Option 3: 40 hours.
Fastness to Crocking: AATCC 8: #4 Wet & Dry.
Flammability: ASTM E 84, Class A or 1.
Basis of design product: Guilford of Maine, FR-701.

2.3 SOUND-ABSORBING AND SOUND-DIFFUSING PANELS

A. General: Provide sound absorbing and sound-diffusing panels meeting requirements of Performance Requirements Article and requirements of this Article, with the following characteristics:

1. Wall Panel Mounting Types for Acoustical Performance Characteristics according to ASTM E 795, with measurements determined according to ASTM C 423:
   A1: Mounted with 9/32 inch (7 mm) air space similar to actual practice.
   A: No air space.
   E-400: 16 inch (410 mm) air space.

B. **Wall Absorber Panels**: Manufacturer's standard panel, with fabric covering laminated to front face of rigid glass-fiber board, with chemically hardened edges, with the following characteristics:
1. Basis of Design Product: Wenger Wall Absorber Panel and Ceiling Absorber Panel.
2. Absorber Panel Size: 3 inch (80 mm) thick, width and length indicated.
3. Fabric Covering: Manufacturer's standard, color and pattern as selected.
4. Wall Panel Mounting Method: Metal wall bracket with panel-mounted z-bracket.
5. Acoustical Performance, One-third Octave Band Center Frequency, Hz, for 48 by 48 inch (1220 by 1220 mm) unit:

	125	250	500	1000	2000	4000
Sound Absorption Coefficient						
Mounting Type A1	0.65	1.10	1.31	1.23	1.20	1.06
Sound Absorption, sabins/unit						
Mounting Type A1	10.4	17.6	21.0	19.7	19.2	17.5
Mounting Type A1	4.0	2.3	1.8	1.7	2.0	2.6

C **Convex Wall Diffuser/Absorber Panels**: Acoustically-configured, selectively sound-absorptive polycylindrical convex molded thermoplastic panel, .125 inch (3 mm) thick, width and length indicated, with sound attenuation board adhered to internal surface of panel.
1. Basis of Design Product: Wenger Type II Convex Wall Diffuser Panels.
2. Fabric Covering: Manufacturer's standard, color and pattern as selected.
3. Wall Panel Mounting Method: Metal wall bracket with panel-mounted grooved button.
4. Sound Transmission Class (STC): ASTM E 90 and ASTM E 413: 23.
5. Acoustical Performance, One-third Octave Band Center Frequency, Hz, for 48 by 96 inch (1220 by 2440 mm) unit:

	125	250	500	1000	2000	4000
Sound Absorption Coefficient						
Mounting Type A	0.34	0.27	0.14	0.11	0.11	0.19
Mounting Type A1	0.28	0.29	0.19	0.13	0.13	0.20
Sound Absorption, sabins/unit						
Mounting Type A	10.8	8.6	4.6	3.4	3.6	6.1
Mounting Type A1	9.1	9.4	6.0	4.1	4.1	6.4

2.4 ACCESSORIES

A. Wall Brackets: Galvanized steel rail configured to accept grooved epoxy buttons or z-brackets attached to panel corners on concealed side.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine acoustical absorber and diffuser panels installation substrates and surroundings for compliance with requirements for installation tolerances, including required overhead clearances, and other existing conditions affecting installation and performance of acoustical absorber and diffuser panels. Proceed with unit installation upon correction of unsatisfactory conditions.

3.2 ACOUSTICAL ABSORBER AND DIFFUSER PANELS INSTALLATION

A. Install units plumb, level, and true. Install in accordance with manufacturer's recommendations and approved submittals.

B. Install wall-mounted acoustical panels utilizing corner mounting z-brackets or grooved buttons and concealed wall brackets. Where indicated, secure units to wall with fasteners along top of unit.

3.3 FIELD QUALITY CONTROL

A. Should completed installation fail to meet requirements, Contractor shall make modifications necessary to correct performance and retest room as directed by Architect to indicate compliance, at Contractor's expense.

3.4 CLEANING

A. Repair or replace defective work as directed by Architect upon inspection.

B. Clean unit surfaces. Touch up, refinish, or replace damaged components in a manner acceptable to Architect.

END OF SECTION 09 8400

SECTION 09 9100 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections of work.
2. “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.
3. Paint walls/ceilings with primer where finished coverings are to be installed.
4. Paint Types, Colors and Finishes – For information, refer to Schedules located on Drawings.
5. Use color prime system per manufacturer’s recommendation.
6. Repair and repainting of metal lockers or other metal surfaces.
7. Repair and painting of existing, hard, slick and glossy surface materials.

B. Paint exposed surfaces, except where natural finish indicates that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint manufacturers prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 05 1200 Section "Structural Steel Framing” for shop priming structural steel.
2. Division 05 5000 Section "Metal Fabrications" for shop priming ferrous metal.
3. Division 06 4023 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
4. Division 08 1113 Section "Hollow Doors and Frames" for factory priming steel doors and frames.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
2. Submit three (3) samples on substrates for Architect's review of color and texture only:

a. Size: 6” x 6” minimum on actual material proposed in the project.
b. Paint color chips and stain colors.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual in continuous business at least five (5) years experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project. Use only thinners approved by the paint manufacturer.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Coordination of Work: 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 or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.

4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing and excessive temperatures where necessary. Keep storage area neat, orderly and well ventilated. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C) or per manufacturer's written instructions.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:

a. Two (2) full unopened gallons of each type of color and finish of paint.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Moore).
2. Devoe Paint.
3. ICI Paint Centers (ICI Paints).
4. Pratt and Lambert (P&L).
5. PPG Industries, Inc. (PPG).
6. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Chemical Components of Interior Paints and Coatings: Provide products that comply with the following:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein.
b. Acrylonitrile.
c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

D. Colors: Colors and Finishes are indicated on the Architect’s drawings.

2.3 EXTERIOR PAINT SCHEDULE

A. Paint colors, finishes and paint types are indicated on Schedules in the Drawings.

B. General: Provide the following paint systems for the various substrates, as indicated.

1. Flat (Lusterless) Polyvinyl Acetate Finish: 2 coats with total dry film thickness of at least 2.5 mils.

a. First and Second Coats: Polyvinyl Acetate Copolymer Emulsion (FS TT-P-55, Type II).
Moore: Moorgard Latex House Paint.
PPG: 6-610 Speedhide Exterior Flat Latex Paint.
P & L: Pro-Hide Plus Interior/Exterior Vinyl-Acrylic Flat Paint.
S-W: Weather Perfect Acrylic Latex Flat Exterior Finish.
Devoe: DR20XX Wonder Guard Flat.
ICI: 2210 Ultra-Hide Durus Exterior Acrylic Flat Finish.

C. Ferrous Metal

1. Full Gloss Alkyd Enamel: 2 Finish coats over primer.

a. Prime Coat: Pigmented Primer (FS TTP-86). Primer is not required on items delivered shop primed. Do not mix “lead” in paints.
Moore: Ironclad Retardo Rust Inhibitive Paint.
S-W: S-W Kem Kromik Metal Primer. Kem Kromik Metal Primer (B50Z Series).
Devoe: DP13201 Mirrolac All-Purpose Metal Primer.
ICI: 4160 Devguard Alkyd Rust Inhibitive Metal Primer.
PPG: 7-852/858 Rust Inhibitive Primer (852=White, 858=Red)

b. First and Second Finish Coats: High Gloss Alkyd Enamel (FS TT-E-489).
Devoe: DP70XX Mirrolac Alkyd Gloss Enamel.
Moore: Impervo High Gloss Enamel Exterior/Interior
PPG: 7-282 Industrial Gloss Enamel.
P & L: Effecto Enamel.
S-W: S-W Industrial Enamel B54 Series.
ICI: 4308 Devguard Alkyd Gloss Industrial Enamel.

D. Zinc-Coated Metal

1. High Gloss Alkyd Enamel: 2 Finish coats over primer.

a. Prime Coat: Zinc Dust-Zinc Oxide Primer (FS TT-P-641).
Devoe: DP13201 Mirrorlac All-Purpose Metal Primer.
Glidden: All-Purpose Metal Primer.
PPG: 6-209 Speedhide Galvanized Steel Primer.
S-W: S-W Galvite Primer (B50 W230).
ICI: 4160 Devguard Alkyd Rust Inhibitive Metal Primer.

b. First and Second Finish Coats: High Gloss Alkyd Enamel (FS TT-E-489).
Devoe: DP70XX Mirrolac Interior/Exterior Alkyd Gloss Enamel.
Glidden: Y-4500-Line – Glid-Guard Alkyd Industrial Enamel.
PPG: 7-282 Industrial Enamel Gloss.
S-W: S-W Industrial Enamel (B54 Series).

ICI: 4308 Devguard Alkyd Gloss Industrial Enamel.

2.4 INTERIOR PAINT SCHEDULE

A. Paint color, finishes and paint types are indicated in schedules in the drawings.

B. General: Provide the following paint systems for the various substrates, as indicated.

C. Concrete Masonry Units

1. Semi-Gloss Alkyd Enamel Finish: 2 Coats over filled surface with total dry film thickness not less than 3.5 mils, excluding filler coat.

a. Filler Coat: Solvent-Thinned Block Filler (FS TT-F-1098). Apply filler coat at a rate to ensure complete coverage with pores filled.
Moore: Moore's Waterproofing Masonry Paint.
S-W: S-W Block Filler. Preprite Block Filler (B25 W25)
ICI: 3010-1200 Ultra-Hide Interior/Exterior Vinyl Acrylic Block Filler.
Devoe: DV52903 Devoe-Fill Block Filler.
Glidden: 5317 Acrylic Block Filler.
PPG: 6-15 Speedhide Block Filler. B25 W25

b. First Coat: Enamel Undercoater (FS TT-E-543).
Devoe: 8801 Velour Alkyd Enamel Undercoat.
Glidden: Y-5019 – PVA Primer.
Moore: Moore's Alkyd Enamel Underbody.
S-W: S-W Pro-Mar Alkyd Semi-Gloss Enamel. (B34-200 Series)
ICI: 1516 Ultra-Hide Interior Alkyd Semi-Gloss Wall and Trim Enamel.
PPG: 6-1110 Alkyd semi-gloss enamel.

c. Second Coat: Odorless Interior Alkyd Semi-Gloss Enamel (FS TT-E-509).
Devoe: 26XX Velour Alkyd Semi-Gloss Enamel.
Glidden: Y-4600-Line – Spred Lustre.
Moore: Moore's Satin Impervo Enamel.
S-W: S-W Pro-Mar Alkyd Semi-Gloss Enamel. (B34-200 Series)
ICI: 1516 Ultra-Hide Interior Alkyd Semi-Gloss Wall and Trim Enamel.
PPG: 6-1110 Alkyd semi-gloss enamel.

D. Gypsum Drywall and Plaster Systems

1. Lusterless (Flat) Emulsion Finish: 2 Coats.

a. First Coat: Interior Latex Base Primer Coat (FS TT-P-650).
Devoe: 50801 Wonder-Tones Latex Flat Wall Paint.
Glidden: PC1000 Primer Sealer.
Moore: Moore's Latex Quick-Dry Prime Seal.
PPG: 6-2 PPG Quick-Drying Interior Latex Primer Sealer.
P & L: Pro-Hide Plus Latex Primer.
S-W: S-W Latex Wall Primer. Preprite Primer B28 W200
ICI: 1030-1200 Ultra-Hide PVA Interior Wall Primer.

b. Second Coat: Interior Flat Latex Base Paint (FS TT-P-29).
Devoe: 36XX Wonder-Tones Interior Latex Flat Wall Paint.

Glidden: Y-3400-Line – Spred Satin Latex Wall Paint.
Moore: Moore's Regal Wall Satin.
PPG: 6-70 Speedhide Latex Flat Wall Paint.

P & L: Pro-Hide Plus Latex Flat.
S-W: S-W Pro-Mar 400 Latex Flat Wall Paint.
ICI: 1210 Ultra-Hide Latex Flat Interior Wall Paint.

E. Ferrous Metal

1. Semi-Gloss Enamel Finish: 2 Coats over primer, with total dry film thickness not less than 2.5 mils. Do not mix "lead" in paints.

a. Prime Coat: Base Primer (FS TT-P-86). Prime coat is not required on items delivered shop primed.
Moore: Iron-Clad Retardo Rust Inhibitive Paint.
S-W: S-W Kromik Metal Primer. Kem Kromik Metal Primer (B50Z Series)
Devoe: DP13201 Mirrolac All-Purpose Metal Primer.
ICI: 4160 Devguard Alkyd Rust Inhibitive Metal Primer.
PPG: 7-852/858 Rust Inhibitive Primer (852=White; 858=Red)

b. First Coat: Interior Enamel Undercoat (FS TT-E-543).
Devoe: 8801 Velour Alkyd Enamel Undercoat.
Glidden: Y-4600 Series Spred Lustre Semi-Gloss Enamel.
Moore: Moore's Alkyd Enamel Underbody.
PPG: 6-1110 Speedhide Alkyd Semi-Gloss Enamel.
P & L: Interior Trim Primer.
S-W: S-W Pro-Mar Alkyd Semi-Gloss. (B34 – 200 Series)
ICI: 1516 Ultra-Hide Interior Alkyd Semi-Gloss Wall and Trim Enamel.

c. Second Coat: Odorless Interior Semi-Gloss Enamel (FS TT-E-509)
Devoe: 26XX Velour Alkyd Semi-Gloss Enamel.
Glidden: Y-4600-Line – Spred Lustre Semi-Gloss.
Moore: Moore's Satin Impervo Enamel.
PPG: 6-1110 Alkyd Semi-Gloss Enamel.
P & L: Pro-Hide Plus Alkyd Semi-Gloss Enamel.
S-W: S-W Pro-Mar Alkyd Semi-Gloss Enamel. (B34 – 200 Series)
ICI: 1516 Ultra-Hide Interior Alkyd Semi-Gloss Wall and Trim Enamel.

F. Zinc-Coated Metal

1. Semi-Gloss Finish: 2 coats over primer, w/ total dry film thickness not less than 2.5 mils.

a. Prime Coat: Zinc Dust – Zinc Oxide Primer Coating (FS TT-P-641).
Devoe: DP13201 Mirrolac All-Purpose Metal Primer.
Glidden: All-Purpose Metal Primer.
Moore: Iron-Clad Galvanized Metal Primer.
PPG: 6-209 Speedhide Galvanized Steel Primer.
S-W: S-W Galvanized Iron Primer. Galvite (B50 W230)
ICI: 4160 Devguard Alkyd Rust-Inhibitive Metal Primer.

b. Second Coat: Interior Enamel Undercoat (FS TT-E-543).
Devoe: 8801 Velour Alkyd Enamel Undercoat.
Glidden: Y-4600 Series Spred Lustre Semi-Gloss Enamel.
Moore: Moore's Alkyd Enamel Underbody.

PPG: 6-1110 Alkyd Semi-Gloss Enamel.
S-W: S-W Pro-Mar Alkyd Semi-Gloss. (B34 – 200 Series)
ICI: 1516 Ultra-Hide Interior Alkyd Semi-Gloss Wall and Trim Enamel.

c. Third Coat: Odorless Interior Alkyd Semi-Gloss Enamel (FS TT-P-509).
Devoe: 26XX Velour Alkyd Semi-Gloss Enamel.
Glidden: Y-4600-Line – Spred Lustre Semi-Gloss.
Moore: Moore's Satin Impervo Enamel.
PPG: 6-1110 Alkyd Semi-Gloss Enamel.
S-W: S-W Pro-Mar Alkyd Semi-Gloss Enamel. B34 – 200 Series
ICI: 1516 Ultra-Hide Interior Alkyd Semi-Gloss Wall and Trim Enamel.

G. Epoxy Paint

1. One coat appropriate primer (compatible filler on block).
2. Two coats TT-P-550 epoxide polyester to produce dry film thickness between 6 and 8 mils.
Sheen: Medium eggshell, unless directed.
3. Vitreous wall surfacing shall be "Liquid-Tile" as manufactured by Evershield Products, Inc., "Gardcote," as manufactured by Devoe, Inc.; "Poly-Tile" as manufactured by Ever-Glaze Wall Surfacing Co., or "Pitt-Glaze" as manufactured by PPG Industries Pittsburgh Paint. SW Epo-Plex Water Based Epoxy (B71 – 100 Series)
4. All vitreous wall surfacing shall be certified to the State Fire Marshal's office as having a Class "A" fire rating.
5. Surfacing work shall be applied by skilled work persons and shall be done in a first class manner in accordance with manufacturer's specifications.
6. Surfacing shall not be applied until after masonry control joints have been caulked.
7. Colors shall be as selected by Architect.
8. Work of other trades shall be properly protected by masking or other approved methods. Remove all masking, boxes and other debris and leave area in broom clean condition at completion of work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Surface Preparation

1. Existing hollow metal frames: SSPC-SP3 Power Tool Clean:
   a. Power tool cleaning removes all loose mill scale, loose rust and other detrimental foreign matter. Before power tool cleaning, remove visible oil, grease, soluble welding residues and salts by methods outlined in SSPC-SP1. For complete instructions, refer to Steel Structures Paint Council Surface preparation Specification No. 3.

C. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

   a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
   c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
   c. If transparent finish is required, backprime with spar varnish.
   d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

    a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

E. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

F. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
    a. Refer to Mechanical Specifications.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.
    a. Refer to Electrical Specifications.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

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

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque 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.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 09 9100

SECTION 10 1100 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Markerboards.
   2. Tackboards.

B. Related Sections include the following:

   1. Division 06 1000 Section “Rough Carpentry.”

1.3 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel joints.
   2. Show location of special-purpose graphics for visual display surfaces.
   3. Include sections of typical trim members.

C. Maintenance Data: For visual display surfaces to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative in business at least three (3) years for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL.

   1. Flame Spread: 25 or less.
   2. Smoke Developed: 10 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated**,** completely assembled in one piece without joints, where possible.

B. Store visual display units vertically with packing materials between each unit.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: The design for each visual display surface is based on the product specified. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
2. Porcelain Enamel Chalkboards and Marker Boards:
    a. Best-Rite Chalkboard Co.
    b. Claridge Products and Equipment, Inc.
    c. Marsh Industries, Inc.
    d. PolyVision Corp.
    e. Other Manufacturers: Submit Substitution Request – refer to Division 01 6000 “Product Requirements” for Architect’s form.

2.2 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7-to-2.5-mil- (0.043-to-0.064-mm-) thick ground coat, and color cover coat; and concealed face coated with primer and 1.7-to-2.5-mil- (0.043-to-0.064-mm-) thick ground coat.

1. Gloss Finish Cover Coat: Gloss as indicated; dry-erase markers with clean with cloth. Minimum 3.0- to –4.0 mil (0.076 – to 0.102 mm) thick cover coat. Cover and ground coats shall be fused at manufacturer’s standard firing temperatures but not less than 1475 deg. F (802 deg. C)
2. Manufacturer’s Product – Basis-of-Design: Claridge Products and Equipment, Inc.; High-Gloss finish for dry-erase markers wipe clean with dry cloth.

B. Particleboard: ANSI A208.1, Grade 1-M-1, made with binder containing no urea formaldehyde.

C. Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

D. Cork Sheet: MS MIL-C-15116-C, Type II.

E. Natural Cork Sheet: Seamless, single layer, compressed fine-grain cork sheet, bulletin board quality; face sanded for natural finish.

F. Plastic-Impregnated Cork Sheet: MS MIL-C-15116-C, Type I, seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto burlap backing; with washable vinyl finish and integral color throughout.

G. Vinyl Fabric: FS CCC-W-408, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with flame-spread index of 25 or less when tested according to ASTM E 84.

H. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd. (508 g/sq. m); with flame-spread index of 25 or less when tested according to ASTM E 84.

I. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

J. High-Pressure Plastic Laminate: NEMA LD 3.

2.3 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly:Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 24 gauge or **0.021-inch- (0.53-mm-) minimum** thick porcelain-enamel face sheet with high-gloss finish.

1. Manufacturers Product – Basis of Design: Claridge Products & Equipment, Inc.
2. Claridge series 5 factory built units. Type A arrangement.
3. Fiberboard Core: 7/16” thick; with **0.005-inch- (0.025-mm-)** thick, aluminum foil backing.
4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
5. Provide Map Rail with corkboard insert continuous across top.
6. Provide continuous chalk trough with end closures.
7. Provide continuous aluminum joint strips between markerboard and adjacent markerboards or Tackboards.
8. 5/8” wide exposed continuous aluminum trim.
9. Furnish steel mounting clips at top, angle clips at bottom, 24” o.c. maximum.
10. For 1 unit in Band Room, include permanent music staff lines.

B. Markerboard Sheet Assembly: Fabricated from 24 gauge LCS Markerboard.

2.4 TACK ASSEMBLIES

1. Manufacturers Product – Basis of Design: Claridge Products & Equipment, Inc.
2. Claridge series 5 factory built units. Type CO arrangement. Join to adjacent markerboards with continuous joint strips when applicable.
3. Designer fabric on cork underlay with ¼” hardboard back.
4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

5. Provide continuous aluminum joint strips between markerboard and adjacent markerboards or Tackboards.
6. 5/8” wide exposed continuous aluminum trim.
7. Furnish steel mounting clips at top, angle clips at bottom, 24” o.c. maximum.

B. Vinyl-Fabric-Faced Tack Assembly: Vinyl fabric factory laminated to **1/4-inch- (13-mm-)** thick fiberboard backing.

1. Tackable surface shall be at least 1/4 inch thick for pin penetration.

2.5 CHALKBOARD, MARKER BOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.

1. Field-Applied Trim: Manufacturer's standard snap-on trim with no visible screws or exposed joints, slip-on trim.
2. Factory-Applied Trim: Manufacturer's standard.
3. Color / Finish: Architect selected from manufacturers full range.

B. Chalktray: Manufacturer's standard, continuous.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
2. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:

1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 2 inches (50 mm) high.
2. End Stops: Located at each end of map rail.
3. Map Hooks and Clips: Two (2) map hooks with flexible metal clips for every **48 inches (1220 mm)** of map rail or fraction thereof.
4. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.
5. Tackable surface shall be at least 3/8 inch thick for pin penetration.

2.6 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
2. Provide manufacturer's standard mullion trim at joints between Chalkboards, Markerboards and Tackboards of combination units.

3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Modular Visual Display Boards: Fabricated with integral panel clips attached to core material.

E. Visual Display Wall Panels: Fabricate panels with 0.0209-inch- (0.55-mm-) thick, porcelain-enamel face sheets.

F. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

2.7 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

D. Powder-Coat Finish: Apply manufacturer's standard baked finish, complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates partitions and conditions, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance where sliding display units are installed.

3.2 PREPARATION

A. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation. Install units at heights indicated here, unless otherwise indicated on Drawings.

1. Mounting Height for Grades K through 3: **24 inches (610 mm)** above finished floor to top of chalktray.

2. Mounting Height for Grades 4 through 6: **28 inches (711 mm)** above finished floor to top of chalktray.
3. Mounting Height for Grades 7 and Higher: **36 inches (914 mm)** above finished floor to top of chalktray.

B. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim to suit manufacturer's standard structural support accessories to suit conditions indicated.

3.4 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 10 1100

SECTION 10 2113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to toilet compartments and screens as follows:

1. Type: Solid-plastic
2. Compartment Style: Overhead braced and floor anchored.
3. Screen Style (urinal): Wall hung.

B. Related Sections include the following:

1. Division 05 5000 Section "Metal Fabrications" for supports that attach units to overhead structural system.
2. Division 10 2800 Section "Toilet and Bath Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

1.3 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings and item locations.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch- (150-mm-) square Samples of same thickness and material indicated for Work.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Scranton Products, Inc.
2. Legacy Polymer Products, Inc.
3. AMPCO Products, LLC
4. Bradmar; Bradley Corp.
5. Global Partitions

2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Solid-Plastic, High-Density polyethylene (HDPE) with homogenous color throughout. Provide material not less than 1 inch (25 mm) thick with seamless construction and eased edges in color and pattern.

1. Colors and Patterns: Colors and patterns in each room as selected by Architect from manufacturer's full range of colors and patterns.

C. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

D. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of the following material:

1. Material: Either stainless steel or clear-anodized aluminum.

E. Panel Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters.

1. Material: Either clear-anodized aluminum or stainless steel.

F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:

1. Material: Either stainless steel or clear-anodized aluminum.

G. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile in manufacturer's standard finish.

H. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip in manufacturer's standard finish.

I. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars.

1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars.
2. Comply with ADA requirements or other agencies having jurisdiction.

B. Solid-Plastic,Compartments and Screens: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.

C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

D. Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Wall-Hung (urinal) Screens: Provide units in sizes indicated, but not less than the following: Panel height to extend from not more than 12” above finished floor to 60” minimum above finished floor and extend a minimum of 18” from face of wall or to a point not less than 6” beyond the outermost front lip of the urinal, whichever is greater. Provide units of same construction and finish as compartment panels, unless otherwise indicated.

1. Provide HDPE screens with integral panel height flanges for attachment to wall.

J. Doors: Unless indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

2.4 ZINC- OR ZINC-ALLOY-COATED STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying finishes.

B. Color-Coated Finish: Provide manufacturer's standard baked finish complying with coating manufacturer's written instructions for pretreatment, application, baking, and minimum dry film thickness.

1. Colors: As selected by Architect from manufacturer's full range of colors.

2.5 STAINLESS-STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

1. Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Finish: Manufacturer's standard No. 4 directional satin polish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than two (2) stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.
2. Comply with ADA requirements or other agencies having jurisdiction.

B. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

C. Provide back-up and partition cavity supports for wall mounted items to other trades during construction progress.

3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to closed position.

END OF SECTION 10 2113

SECTION 10 2800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to the following:

1. Refer to Drawings for additional toilet accessories types and information.

a. Washroom accessories.

B. Owner-Furnished Material:
1. Owner will provide and contractor will install soap dispensers, sanitary napkin dispensers and receptacles, paper towel dispensers and receptacles and toilet paper dispensers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify products for locations using room designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required for the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal ¼ inch thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Manufacturer’s Product - Basis-of-Design: Bobrick. Subject to compliance with requirements, provide the named product or a comparable product acceptable to the Architect.

Note: Accessories are scheduled on the Drawings.

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

2.3 UNDER-LAVATORY GUARDS

A. Manufacturer's Product - Basis-of-Design: The design for accessories is based on products indicated. Subject to compliance with Barrier Free requirements, provide the named product or a comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.
4. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
5. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 ELECTRIC HAND DRYERS

A. Manufacturer's Product - Basis-of-Design: Bobrick Trimline Surface-mounted Hand Dryer.

1. Trim-Line Surface Mounted ADA Dryer B-7128
   a. Touch free operation
   b. 73 dBA, maximum.
   c. 4" maximum projection.
   d. 115V AC, 15 amp, 1725 Watts, 50/60Hz, Single Phase, cULus Listed.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 2800

SECTION 10 5113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to the following:
   1. Athletic metal lockers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Show base, sloping tops, filler panels, recess trim and other accessories.
   2. Include locker numbering system.

      a. Review and coordinate with Owner and Architect to interface numbering with existing locker numbering, if applicable.

C. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain all metal lockers and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal lockers and are based on the specific system and design indicated.

D. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and governing agencies having jurisdiction.

1. Lockers shall comply with all features to suit barrier-free accessibility. Provide a “decal” with the international symbol of accessibility to the face of locker doors and other required Barrier Free features.
2. Provide Barrier Free accessible locker in quantities of not less than 5% of total units, but not less than one (1) of each type.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

B. Deliver master and control keys, master, penalty, and control keys, combination control charts to Owner.

1. Provide at least ten (10) keys of each unit type to the Owner.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:

1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
2. Recessed openings.
3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate size and location of concrete, concrete masonry, wood bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed.

C. Coordinate miscellaneous steel supports for cantilevered benches projecting from walls.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship.

1. Warranty Period for Metal Lockers: Ten (10) years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below, before construction begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Full-size units of the following metal locker hardware items equal to ten (10) percent of amount installed for each type and finish installed, but no fewer than five (5) units:

a. Locks and latch assembly.
b. Hooks.
c. Hinges.
d. Interior shelves.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturer's Product Basis-of-Design: The design for each metal locker specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.

B. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.

E. Plastic Laminate: NEMA LD 3, Grade HGP.

F. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

G. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls **and elsewhere as required** for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 ATHLETIC LOCKERS

A. Manufacturer's: **Republic Storage Systems, LLC.** Products by other manufacturers may be approved provided they meet the detailed specifications written below.

1. Other manufacturers:
   a. ASI Lockers
   b. Art Metal Products, Div. of Fort Knox Storage Co.; Corridor Lockers.
   c. DeBourgh Mfg. Co.
   d. Penco Products, Inc., Subsidiary of Vesper Corporation Lockers.
   e. Lyon Workspace

2. .Product Basis-of-Design: Republic Storage Systems Single Point 2 Athletic Lockers (knock down).

3. Republic Single Point II

4. Sizes
   a. L1- 12”x12”x30” double tier sloped top (MS boys locker room)
   b. L2- 12”x12”x24” double tier (MS boys locker room)
   c. L3- 12”x12”x30 single tier sloped top (HS Pool locker room)
   d. L4- 12”x12”x60” single tier sloped top (HS Pool locker room)
   e. L5- 12”x12”x30” double tier sloped top (HS Pool locker room)

B. Lockers:
1. Style: Single Point II
2. Configuration: See plans
3. Color: Full range
4. No. of Locker Frames: Field verify – see plans
5. No. of Locker Openings: Field verify – see plans

C. **Material:** All major steel parts shall be of mild cold rolled commercial quality steel.

D. **Finish:** All material shall be power washed and phosphate treated for maximum finish color adhesion. All components shall be finished with a 2 mm hybrid epoxy/polyester powder, electrostatically applied to ensure uniform thickness and baked to cure.

E. **Construction:** All lockers shall be built on a unit principle with common intermediate uprights separating units.

F. **Door Frames:** Shall be 16 gauge formed in a channel shape. Vertical members shall have additional flange to provide a continuous door strike. Cross frame members shall also be 16 gauge channel shaped, including intermediate cross frames on double and triple tier lockers.

G. **Doors:** Construction shall be a single piece 14 gauge outer door with double return flanges on both vertical edges and a single return flange on the top and bottom edges. Doors on tiered lockers shall be reinforced with a full height 16 gauge channel reinforcement. Ventilation consists of full perimeter opening plus, Verti-vent slots in the top and bottom of doors. Doors shall be punched for the number plate mounting on the top face of the door.

H. **Ventilation:** All locker sides and doors 20" or higher shall be perforated with diamond-shaped openings ¾" wide x 1-1/2" high in a quantity and pattern to ensure maximum ventilation and maintain structural strength. All other doors shall have small diamond-shaped perforations 7/16" wide x 15/16" high.

I. **Latching**: Latching shall be achieved by securing an 11 gauge frame hook to the locker side frame located midway up on the door. This frame hook shall have a padlock hasp protruding through the stainless steel recessed pocket and also will have punching to accept Master Lock 1690 or 1790.

J. **Handles**: A one piece, deep drawn stainless steel cup shall be securely riveted to the door to form a receptacle for the padlock or built-in lock. The pocket shall also have a formation across the top that provides a door pull. This stainless steel pocket shall contain a recessed area for the various lock types.

K. **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" shall have three hinges.

L. **Body**: The body of the locker shall consist of 24 gauge upright sheets, backs, tops, bottoms and shelves. Tops, bottoms and shelves are 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.

M. **Interior Equipment**: Single tier lockers over 42" high shall have one hat/book shelf. Other tiered lockers do not require shelves. All single, double and triple tier lockers shall have one double prong rear hook and two single prong side hooks in each compartment. All hooks shall be made of steel, formed with ball points, zinc-plated and attached with two bolts or rivets. Locker openings under 20" high are not equipped with hooks.

N. **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 top face of the locker door for high visibility.

O. **Color**: Doors and exposed body parts shall be finished in colors selected from Republic's collection of twenty-five baked enamel colors. Color full range. Non-exposed body parts shall be finished in #83 Decorator Tan (baked enamel).

P. **Assembly**: Welded assembly.

Q. **Equipment**: Equip each metal locker with identification plate and the following, unless otherwise indicated:

1. Single tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

R. Accessories:

1. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet; approximately 20-degree pitch.
   a. Closures: Vertical end type.

2. Locker Base: Provide 4" high 16 gauge zee base under new lockers in MS boys Locker room against new wall – all other lockers will be on existing tile or terrazzo base.

3. Recess Trim: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.

4. Filler Panels: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.

5. Boxed End Panels: Fabricated from 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet.

2.4 FABRICATION

A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Knocked-Down Construction: Fabricate metal lockers for nominal assembly at Project site using nuts, bolts, screws, or rivets. Factory weld frame members together to form a rigid, one-piece assembly.

D. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

F. Coat Rods: Fabricated from 3/4-inch- (19-mm-) diameter steel; nickel plated.

G. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum or plastic plates; with numbers and letters at least 3/8 inch (9 mm) high.

H. Continuous Base: Formed into channel or Z profile for stiffness, and fabricated in lengths as long as practicable to enclose base and base ends of metal lockers; finished to match lockers.

I. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers unless noted otherwise – see Middle School boys locker room for size without sloped tops

1. Sloped top corner fillers, mitered.

J. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practicable; finished to match lockers.

K. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.

L. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

M. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

N. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

E. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Metal Lockers: Assemble knocked-down metal lockers with standard fasteners, with no exposed fasteners on door faces or face frames.

C. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.

D. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

4. Attach recess trim to recessed metal lockers with concealed clips.
5. Attach filler panels with concealed fasteners. Locate fillers panels where indicated on Drawings.
6. Attach sloping top units to metal lockers, with closures at exposed ends.
7. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
8. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION 10 5113

SECTION 11 6633 - GYMNASIUM EQUIPMENT

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 RELATED SECTIONS

A. This section includes the following gymnasium equipment:

1. Basketball backstop height adjustment system.
2. Gymnasium wall protection pads

1.3 SUBMITTALS

A. Submit color samples for all equipment.

1.7 PROJECT CONDITIONS

A. Examine existing and new work in place on which specified work is in any way dependent to ensure that conditions are satisfactory for installation of specified work. Report in writing to the General Contractor and the Architect any defects. Absence of such notification will be construed as acceptance of work in place. Do not attempt installation until correct conditions are present.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The gymnasium equipment specified, in order to establish performance and quality of products. Manufacturer's Product, Basis-of-Design: shall be "American Athletic – Division of Russell Corp." Phone: (1) 800-745-4695.

1. American Athletic – Division of Russell Corporation.
2. Draper, Inc.
3. Porter Athletic Equipment Co.
4. Performance Sports Systems. (PSS)

B. Other Manufacturers desiring consideration are invited to bid provided they submit to the Architect or Owner through the Construction Manager or General Contractor complete specifications, cuts, descriptions, detailed list of similar installations of the proposed materials for proper evaluation prior to ten (10) days before Bid Date. The Architect will review and, if acceptable, will issue an addendum to all contractors/bidders.

1. Submit request complying with information on the Architect's standard Substitution Request form located in Specification Section 01 6000 – Product Requirements – Options and Substitutions.

C. The approval of other manufacturers names and product numbers do not relieve the contractor from furnishing products, which comply with all of the technical and detailed requirements of these specifications.

D. Manufacturer's products shall be standard cataloged items and shall be a CONSISTENTLY OFFERED LINE OF EQUIPMENT. Manufacturers published literature must clearly show that the products being furnished are in compliance with these specifications. Otherwise, a detail listing of differences is required prior to bid.

E. Manufacturers shall be in continuous business at least five (5) years with experience producing equipment of the type and design specified. Manufacturer must be able to furnish at least five (5) installations within the last five (5) years of recent projects with products in compliance with these specifications.

2.2 MATERIALS

A. Height Adjustment system for Basketball Backstops – Basis of Design: Porter Athletic

a. Center-Strut height adjustment system for rectangular backboard – manual operation: 00600-506. 2 Total units

B. Wall Padding – Total Units Required: Full length of the wall indicated on Drawings.

Basis of Design: American Athletic

1. Wall wainscot shall consist of panels 2'-0" minimum width x HEIGHT AS INDICATED. (Quantities as shown on the drawings)
2. Panels will be constructed of 2" bonded foam filler cemented to 3/8" backing board and covered with Flame Retardant, vinyl-coated polyester folded and stapled securely to back of oriented strand board. A 1" nailing margin shall be provided to top and bottom for securing panels to the wall.
3. The cover material shall have a tear strength of 100 P.S.I. and shall be mildew and rot resistant and fortified with an infection combating fungicide. Architect shall select color from Manufacturer's full color range.
4. All cutouts in panels shall be made in field to fit job conditions.
5. Panels must be inspected before installed. CAUTION: To minimize wrinkles in fabric of installed panels, wall must be either perfectly plumb, or slightly convex (bowed out) over the area to be covered. If found to be concave (bowed in), install sufficient shims at midsection of panels to provide plumb or convex wall profile.
6. The installing contractor shall be responsible for proper inspection and installation of all panels. Installation shall be made in accordance with current factory suggested procedures.
7. Panel clips shall be provided to allow for removal of vandalized panels by simply lifting the panel upward. Clips are furnished in heavy, precision extruded aluminum (6063-T5) extrusion with attachment holes pre-drilled.
8. Wall attachment clips shall be 6'-0" in length with the capability of field cutting to length as required. Clip is designed for mounting to the wall for use in combination with Clip channel. Wall attachment clip shall be pre-drilled with 13/64" diameter holes on 9" centers for mounting to wall.
9. American Athletic Clip channels shall be 6'-0" in length, designed for mounting either on the wall to accept the lower 1" lip on standard wall pad panels, or a snap on type trim molding for the top lip as required.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.

INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.

ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

CLEANING AND PROTECTION

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

END OF SECTION 11 6633

NET TENSION SYSTEM

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
3. Section 32 1217 Plant Mix Bituminous Asphalt Pavement

1.2 SCOPE

A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary for installation of a complete net tension system. Work to include but not limited to, excavation and concrete for post footings and net posts and accessories.

1.3 QUALITY ASSURANCE

A. Warranty Guarantee: The Contractor and any Sub-contractor 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.

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 - PRODUCTS

2.1 NET TENSION SYSTEM

A. Net posts shall be seven gauge (7ga.) galvanized steel having an outside diameter of not less than three inches (3") and shall be equipped with self locking re-coiless tension system. Posts and sleeves shall be located where indicated on the drawings or details. Post shall be set plumb and true so as to support the net at a height of forty-two inches (42") above the court surface at each post. Post shall be selected by Owner. One set of PVC end plugs shall be included with each set of net posts.

B. Posts and sleeves shall be from one of the following manufacturers:

1. Gold Medal, Deluxe Style No. 62-89-0419 Phone: (800)-633-2354
2. Douglas Industries, DTP-37 Phone: 800-553-8907
3. Edwards, (Collegiate Pacific) Phone: (888)- 566-8966

C. Tennis nets shall be a polypropylene netting system with three millimeter (3mm) black braided thickness. The headband shall be double stitched vinyl with a cable system not less than forty-seven feet (47') long and with three thousand pounds (3000 lbs) tensile strength. The cable shall be five millimeters (5mm) in diameter galvanized steel cable PVC coated, with looped ends and clamps for three thousand pounds (3000 lbs) test tensile strength.

D. Each net must be accompanied by a two inch (2") wide white nylon center strap with adjustable swivel hook. Nets and straps supplied by:

1. Edwards, Modus, Connecticut, Classic Deluxe Net 30 DS
2. Gold Medal, Super Masterpiece
3. Douglas Industries, TN-30

E. One center strap anchor shall be installed for each court.

2.2 CONCRETE

A. Concrete shall conform to Section 03 3010 Portland Cement Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not install net tension system until leveling course has been installed.

B. Install ground sleeves prior to wearing course installation.

3.2 INSTALLATION

A. Net tension system post foundations shall not be less than fifteen inches (15") in diameter at the top, not less than thirty inches (30") in diameter at the bottom and not less than forty-eight inches (48") deep. Posts shall be set to have forty-two feet (42') on center. Posts and sleeves shall be located where indicated on the drawings or details. Posts shall be set plumb and true so as to support the net at a height of forty-two inches (42") above the court surface at each post. Center strap anchors shall be positioned as shown on the details as set in concrete footings as shown on the drawings and/or details.

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 6826

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 NFHSA 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 goal anchoring system, shall be from one of the following manufacturers:

1.	Aluminum Athletic Equipment Co. (AAE)	810-984-8328
2.	SportsEdge	800-334-6057
3.	KwikGoal	800-531-4252
4.	Sportsfield Specialties	888-975-3343
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 manufacturer approved safety anchor system.
5. Nets: 4mm braided polypropylene, 5.5” square mesh.

C. Full size square soccer goals complete with nets, wheel kits and safety anchor systems, 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	2B3806W	Round
	Net	Included	
	Wheels	Included	
3. Sportsfield Specialties	Goal	SG4950	Round
	Net	1564955	
	Wheels	Included	
4. SportsEdge	Goal	2B3806W	Round
	Net	Included	
	Wheels	Included	

***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. Assemble as per manufacturer's cut sheets.
B. Install safety anchoring system per manufacturer's instructions.

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

PROTECTIVE NETTING SYSTEM

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

1.2 SCOPE

A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary for a complete protective netting system as detailed.

B. The work under this section of the specifications is scheduled as an Alternate, Refer to Proposal Form.

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 date of filing notice of completion and acceptance by Owner. Standard manufacturer's warranty shall apply to products installed.

B. Materials delivered to the site shall be examined for damage or defects. Any defects shall be noted and reported to the Owner's representative. Replacements, if necessary, shall be immediately re-ordered, so as to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or indoors.

C. All protective netting materials and hardware shall be a complete system and provided by a single manufacturer. Individual components from various manufacturers making up a protective netting system will not be accepted.

1.4 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 BALL SAFETY NETTING SYSTEM

A. Approved Manufacturers (or equal):

Sportsfield Specialties Phone (888) 975-3343	
Aluminum Athletic Equipment (AAE) Phone: (800) 523-5471	

B. Poles:

Post Height	Post Spacing	Post Diameter	Post Type
0' – 20'	20' O.C.	4" minimum	Aluminum, 0.125" thick
20' – 40'	20' O.C.	4" minimum	Per Manuf. Recommendations

C. For heights 25 feet and under, posts shall be 4" aluminum with a minimum wall thickness of 0.125". For heights over 25 feet, posts shall be 4" Schedule 40 steel pipe or 4" aluminum (per manufacturer's recommendations). Length, above grade, shall be sized as shown on plan. Assembly shall also be able to withstand 80 mph winds with gust factor of 1.3. Poles shall be powder coated Black.

D. Ground Sleeves: 7" O.D. steel tube with aluminum ground sleeve caps. Length shall be per manufacturer's recommendations.

E. Accessories: The following shall be included with each ball safety system:

1. Stainless steel assembly hardware
2. Shell block pulley system
3. 9.0 inch net guide rings

4. Soil Conditions: The design criteria for these specifications are based on soil conditions with 3,000 psf or greater lateral load. It shall be the Contractor's responsibility to notify the Owner's representative of soil conditions other than the design criteria. The Owner shall then be responsible and absorb the cost to provide pole bases for soil conditions less than 3,000 psf.

2.2 NETTING

A. Products Specifications:

1. Twine:	#36 Nylon
2. Mesh Size:	1-3/4"
3. Mesh Style:	Square
4. Color:	Black
5. Finish:	UV-Stabilized, Heat-Set
6. Flame Retardancy:	None
7. Break Strength:	180 lbs.
8. Weight:	1.75 lbs. per 100 sq. ft.
9. Border/Edging:	¼" MFP Rope

B. Size: As noted on drawings.

2.3 ACCESSORIES

A. All accessories (pulleys, clamps, clips, winches, fastener, etc.) are to be hot dipped galvanized or stainless steel.

B. Cabling to be ¼" stainless steel aircraft cable with stainless steel hog ties to attach net.

PART 3 - EXECUTION

3.1 POLE INSTALLATION

A. Excavation: The Contractor may excavate by any means he prefers, insofar as these methods conform to these specifications and manufacturer's recommendations. Holes shall be excavated with diameters not less than eight (8) inches greater than the largest dimension of poles being installed. Required depth of pole holes shall be 10% of overall pole length plus not less than two (2) feet or more than five (5) feet.

1. The bottom of the pole holes shall be on undisturbed earth. If a pole hole is excavated to a depth greater than required, it shall be backfilled with specified crushed rock, placed in six (6) inch layers, and thoroughly machine tamped to approximate density of surrounding soil.

B. Backfill: The backfill for all pole holes shall be entirely crushed rock placed from the bottom of the pole hole to the distance of 18 inches below the top of the hole and topped with excavated soil. All backfill shall be placed in six (6) inch layers and each layer shall be thoroughly tamped to approximate density of surrounding soil. The soil backfill shall be banked and tamped around the poles to a height of 12 inches above the natural ground line.

1. The crushed rock backfill shall be Class A road limestone which consists of rock grades of the following sieve analysis:

100% by weight - pass 1 inch sieve
60-90% by weight - pass ½ inch sieve
40-60% by weight - pass No 4 sieve
25-50% by weight - pass No 8 sieve
20-40% by weight - pass No 16 sieve
5-15% by weight - pass No 200 sieve

2. Percentage of wear, when tested according to AASHTO T96, Grading B, shall not exceed 45.
3. Subject to Owner's approval, surplus material shall be uniformly spread at the site or removed and disposed of at Contractor's expense. Care shall be taken that the spreading of surplus material does not result in the channeling of run-off water past pole locations.

C. Variance: If crushed rock is not readily available, poles shall be set and backfilled with approved MDOT Class II sand or with materials and procedures in accordance with standard specifications.

D. All cabling to be double clamped.

E. Attach netting to horizontal top cable and side cables using 5/16" x 2 3/8" stainless spring snap ring. Attach bottom edge to fence fabric using reusable type cable ties.

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 Owner. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 11 6842

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SECTION 12 2116 - VERTICAL LOUVER BLINDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to the following: Vertical louver blinds, aluminum vanes, PVC vanes , Fabric Vanes and PVC vanes with fabric vane

B. Related Sections include the following:

1. Division 06 1000 Section "Rough Carpentry" for wood blocking and grounds for mounting vertical louver blinds and accessories.

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for vertical louver blinds.

C. Samples for Verification: For each type of vertical louver blind indicated.

1. Vane: Not less than 12 inches (300 mm) long.
2. Vane Fabric: 4-inch- (100-mm-) wide, full-length Sample. Show complete pattern repeat.
3. Vertical Louver Blind: Full-size unit, not less than 16 inches wide by 24 inches long.
4. Valance and Cornice: Full-size unit, not less than 12 inches (300 mm) wide.

D. Window Treatment Schedule: For vertical louver blinds. Use same designations indicated on Drawings.

E. Product Certificates: For each type of vertical louver blind, signed by product manufacturer.

F. Maintenance Data: For vertical louver blinds to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain vertical louver blinds through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide vertical louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Flame-Resistance Ratings: Passes NFPA 701.
2. Additional acceptance by Codes and other agencies having jurisdiction.

C. Product Standard: Provide vertical louver blinds complying with WCSC A 100.1.

D. Mockups (On-site): Build in-place mockups in locations as directed by the Architect to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name, **fire-test-response characteristics, lead-free designation,** and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install vertical louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where vertical louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Vertical Louver Blinds: One box of full-sized for each size, color, texture, pattern, and gloss indicated.
2. Vanes: One box of full-size units of each type, color, and size installed.

PART 2 - PRODUCTS

2.1 VERTICAL LOUVER BLINDS

A. Manufacturer’s: Subject to compliance with requirements, provide one of the following:

1. Hunter Douglas.
2. Springs Window Fashion Division, Inc.
3. Levolor
4. Silent Gliss USA, Inc.

5. Am-Source International.

2.2 PRODUCT DESCRIPTION

A. Vertical louver blinds consisting of evenly spaced, synchronized louver vanes and rail system with self-aligning carrier mechanisms, carriers, traverse and vane directional mechanisms and controls, and installation hardware.

B. Louver Vanes: Lead-free, UV stabilized, integrally colored, opaque, permanently flexible, extruded .032 inch thick PVC that will not crack or yellow; with flat profile and not less than 3/8" overlap when vanes are rotated fully closed. Nominal vane width to be 3".

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; channel-shaped enclosing operating mechanism. Wheeled carriers to be engineered plastic with self-lubricating wheels.

D. Vane Directional Control: Manual with nickel-plated metal bead chain automatic rotation mechanically activated by traversing control.

1. Traversing Control: Manual with cord.
2. Draw and Stack Position: To be determined by Architect.

E. Mounting: Ceiling or end mounting permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacer and shims required for blind placement and alignment indicated.

1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

2.3 VERTICAL LOUVER BLIND FABRICATION

A. Product Description: Vertical louver blind consisting of equally spaced, synchronized vanes and rail system with self-aligning carrier mechanisms, carriers, traverse and vane directional mechanisms and controls, and installation hardware.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Louver Directional and Traversing Control Mechanisms: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Blind Units Installed between (inside) Jambs: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm), less than head-to-sill dimension of opening in which each blind is installed.
2. Blind Units Installed outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance and operating hardware, and for hardware position and blind mounting method indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, unless anodized or plated finish is indicated. Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Component Color: Provide cords and exposed-to-view metal and plastic matching or coordinating with vane color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, **accurate locations of connections to building electrical system,** and other conditions affecting performance.

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

3.2 INSTALLATION

A. Install vertical louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior vane edges in any position are not closer than [**2 inches (51 mm)**] to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

B. Flush Mounted: Install vertical louver blinds with vane edges flush with finish face of opening when vanes are tilted open.

C. Jamb Mounted: Install headrail flush with face of opening jamb and head.

D. Head Mounted: Install headrail on face of opening head.

E. Recessed: Install headrail concealed within blind pocket.

F. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

A. Adjust vertical louver blinds to operate smoothly, easily, safely and free of binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean vertical louver blind surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that vertical louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged vertical louver blinds as directed by Architect.

END OF SECTION 12 2116

SECTION 12 2413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but not limited to roller shades:

1. Motorized shade operators.

B. Related Sections include the following:

1. Division 05 5000 Section "Formed-Metal Fabrications" for custom sheet-metal pockets for window treatments.
2. Division 06 1000 Section "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
3. Division 08 5113 Sections “Aluminum Windows” for windows, window walls, and curtain walls with roller shades mounted on window frames.
4. Division 26 Sections “Electrical” Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

1. Motorized Shade Operators: Include operating instructions.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

1. Shade Operators: Show locations and details for installing operator Motorized components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
2. Wiring Diagrams: Power, system, and control wiring.

C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension system members and attachment to building structure.

2. Ceiling-mounted or penetrating items including light fixtures; air outlets and inlets; speakers; sprinklers; recessed shades; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
3. Shade mounting assembly and attachment.
4. Size and location of access to shade operator, motor, and adjustable components.

D. Samples for Verification:

1. Shade Material: Not less than 12-inch- (300-mm-) square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
2. Valance: Full-size unit, not less than 12 inches (300 mm) long.

E. Window Treatment Schedule: Include roller shades in schedule using same room designations indicated on Drawings.

F. Product Certificates: For each type of roller shade product, signed by product manufacturer.

G. Product Test Reports: For each type of roller shade product.

H. Maintenance Data: For roller shades to include operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer in continuous business at least three (3) years and who has completed installation of roller shades similar in material, design, and extent to that indicated for this Project.

B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after construction is completed and finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable window units' operation hardware throughout the entire operating range.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Draper Shade & Screen Co., Inc.
2. MechoShade. Systems, Inc.
3. Hunter Douglas Window Fashions
4. SOS

2.2 ROLLER SHADES

A. Roller Shades:

1. Manufacturer’s Product: Basis of Design.

a. Manufacturer: ElectroShade Systems, Inc.’s Vertical Room Darkening Shade System.
b. Motorized operation.

2. Materials and Fabrication:

a. Shade Brackets: Cadmium plated 1/8” (min.) thick steel of appropriate size and configuration to support shading system.
b. Shade Roller Tube(s): Extruded aluminum tube, 6063-T6 alloy 1-3/4" (44cm), 2-1/2" (63mm), 3-1./2" (90mm), or 4-1/2" (114mm) OD (as required) with internal keyway to receive tubular motor. The tube is extruded with two fabric mounting channels designed to support the shade bands via a snap-loc spline.
c. Mounting spline Extruded vinyl with asymmetrical locking channels and embossed fabric guide for use with 1-3/4 in. (44 mm), 2-1/2 in. (63 mm), 3-1/2 in. (90 mm) or 4-1/2 in. (114 mm) OD tube. Spline has sufficient capacity to support the shade and additional hem weights without disengaging from the tube or without extra wraps of fabric on the tube. SnapLoc Spline shade band assembly may be installed or removed from the shade tube, or tube/motor assembly, without disassembling or removal from the mounting brackets.
d. End Brackets**:** Consist of 1/8 in. (3 mm) thick sheet steel. Wall, jamb or ceiling mounted as required and permanently installed.
e. Center Support Brackets: Supplied to allow multibanding. Ceiling or wall mounted. Center support brackets shall accept continuous lengths of fascia, which will span

two or more ElectroShade bands up to maximum length of 15 feet (457cm) per section.

f. Hembar Weights: Mill-finished aluminum bars in singlelengths as appropriate for the size shade, concealed in afabric hem pocket.

3. Fabric:

a. Fabric: **EuroVeil 5300 Series Shade Cloths Approximately 5% openness factor**.

b. Shadecloths shall be woven of .010" or .018" opaque, extruded vinyl-coated polyester yarn consiting of approximately 79% reinforced vinyl and 21% polyester core yarn. The shadecoth shall betensioned in the finishing range prior to heat setting to keep warp ends straight, minimize or eliminate weave distoration, and keep the shadecloth flat. The fabric shall be finished with heat and pressure and be dimensionally stable. The width is the manufactured standard width.

c. Passed FR tests: CCC-C-521E, ASTM E84-81, ASTM E162, and NFPA 701 Large-Small Scale Vertical Burn test.

B. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as required for removable design for access.

C. Top/Back Cover: L shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.

D. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.

E. Mounting: Mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

F. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

2.3 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings.

1. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, headbox, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.

2.4 MOTORIZED ROLLER SHADE OPERATORS

A. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.

B. Comply with NFPA 70.

C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

D. Electric Motors: UL-approved or -recognized, asynchronous, totally enclosed, insulated, capacitor-start motors, complying with NEMA MG 1, with thermal overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.

1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
2. Motor Characteristics: Single phase, 110V, 60 Hz, unless otherwise required.
3. Motor Mounting: Within manufacturer's standard roller enclosure.

E. Position of Motor and Electrical Connection: Side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated.

F. Individual/Group Control Stations: Maintained-contact, three-position, rocker-style, wall switch-operated control station with open, close, and center off functions for individual and group control.

G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.

H. Operating Function: Stop and hold shade at any position.

I. Operating Features: Include the following:

1. Group switching with integrated switch control; single face plate for multiple switch cut-outs.
2. Override switch.
3. Back-up gear and crank operator for manual operation during power failures with detachable handle, length required to make operation convenient from floor level.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass, unless otherwise indicated. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

B. Replace damaged roller shades as directed by the Architect.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 12 2413

SECTION 12 3210 – INSTITUTIONAL CABINET CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes base and wall cabinets of the following:
   1. Plastic-laminate-faced wood cabinets of stock design.
   2. Plastic-laminate countertops.
   3. Solid-surfacing-material countertops.
   4. Wall shelving.
   5. Casework information is scheduled on the Drawings.

B. Related Sections include the following:

   1. Division 06 1000 Section "Rough Carpentry" for wood blocking for anchoring institutional casework.
   2. Division 06 4023 Section "Interior Architectural Woodwork."
   3. Division 09 2900 Section "Gypsum Board" for reinforcements in gypsum board partitions for anchoring institutional casework.

1.3 SCOPE OF WORK

A. Furnish and install casework and equipment complete with all accessories, control devices and fittings necessary for operation.

B. Existing Equipment: Verify existing equipment as supplied by Owner at job site for size and location.

C. Casework Contractor shall include in their bid all cabinet units, aprons, supports, applied facing and other necessary requirements required to complete this package as indicated on drawings and in the specifications.

   1. Refer to Specification Division 06 4023 Section “Interior Architectural Woodwork.”

1.4 WORK NOT SPECIFIED

A. Furnishing or installation of resilient base at toe spaces, rough-in, and final connection of plumbing and electrical items.

1.5 DEFINITIONS

A. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches (1220 mm) above floor, and surfaces visible in open cabinets.

B. Semiexposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches (1980 mm) or more above floor are defined as semiexposed.

C. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.

1.6 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for institutional casework. Include plans, elevations, sections, details, and attachments to other Work.

C. Samples for Verification: 6-inch- (150-mm-) square Samples for each type of finish, including top material.
1. Samples of colors and finishes for each type of unit.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative in business at least five (5) years of institutional casework manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain institutional cabinet casework through one source from a single manufacturer.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards," Section 01 6000 “ Product Requirements.”

1. Provide AWI Quality Certification Program labels or certificate indicating that institutional casework complies with requirements.

D. Product Designations: Drawings indicate sizes, configurations, and finish material of institutional casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish material, and complying with the Specifications may be considered.

1. Comply with the Manufacturer’s Product - “Basis of Design” as indicated and scheduled in the Architect’s Drawings.

E. Product Designations: Drawings indicate institutional casework configurations by referencing WIC design series numbering system as defined in WIC's "Manual of Millwork."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver institutional casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Deliver and install institutional casework when building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where institutional casework is indicated to fit to other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate layout and installation of metal framing and reinforcements in gypsum board assemblies for support of institutional casework.

1. Provide built-in anchorage and support items as required to suit casework installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of institutional cabinet casework that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five (5) years from date of Substantial Completion.

1.12 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and finish of institutional casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged casework finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer’s Product - Basis-of-Design: The design for institutional cabinet casework is scheduled on the Architect’s Drawings. Subject to compliance with requirements, provide the named product or a comparable product acceptable to the Architect complying to specified criteria by one of the following:

1. Plastic-Laminate-Faced Institutional Casework:

   a. Basis of Design: Stevens Industries

   b. Case Systems, Inc.
   c. Fisher Hamilton Inc.
   d. LSI Corporation of America, Inc.
   e. TMI Systems Design Corp.
   f. Strata Design.
   g. Wood Metal Industries

2. Plastic-Laminate Material:

   a. Formica Corporation.
   b. International Paper; Decorative Products Div.
   c. Laminart.
   d. Pioneer Plastics Corp.
   e. Wilsonart International; Div. of Premark International, Inc.

3. Solid-Surfacing Material: For Countertops and sills

   a. Corian

   b. Avonite, Inc.

2.2 MATERIALS

A. General:
   1. Adhesives: Do not use adhesives that contain urea formaldehyde.
   2. Maximum Moisture Content for Lumber: 7.0 percent for hardwood and 12.0 percent for softwood.
   3. Hardwood Plywood: HPVA HP-1, either veneer core plywood made without urea formaldehyde.
   4. Softwood Plywood: DOC PS 1.
   5. Particleboard (shelving only): ANSI A208.1, Grade M-2-Exterior Glue.
   6. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
   7. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
   8. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick matching color doors and drawer fronts.
   9. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch- (3-mm-) thick, solid wood of same species as face veneer.

B. Exposed Plastic Laminate Wood Cabinet Materials: Type -VGS.

   a. Unless otherwise indicated, provide plastic laminate for exposed surfaces.
   b. Provide plastic laminate for doors and drawer fronts.
   c. Plastic-laminate finished surface materials shall be selected from plastic-laminate manufacturer's full range of colors and finishes.

C. Semiexposed Cabinet Materials:

   1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of same species as exposed solid wood.
   2. Plywood: Hardwood plywood of same species as exposed plywood. Semiexposed backs of plywood with exposed faces shall be same species as faces. Grade B faces and Grade J crossbands.

3. Plastic Laminate: Type -VGS.

   a. Provide plastic laminate for semiexposed surfaces, unless otherwise indicated,.
   b. Provide plastic laminate for interior faces of doors and drawer fronts and where indicated.

4. Melamine-Faced Particleboard (shelving only): Particleboard with decorative surface of thermally fused, melamine-impregnated web and complying with LMA SAT-1.

5. Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A 366/A 366M; matte finish; suitable for exposed applications.

D. Concealed Cabinet Materials:

1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood. Concealed backs of plywood with exposed or semiexposed faces shall be same species as faces.
3. Plastic Laminate: Type -BKL.

2.3 DESIGN, COLOR, AND FINISH

A. Design: Provide institutional casework of the following design:

1. Cabinet Front Design:

   a. Flush Overlay and radius edges with 1/8 inch maximum gaps.

B. Melamine-Faced Particleboard Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.

C. Plastic-Laminate Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.

2.4 CABINET FABRICATION

A. Plastic-Laminate-Faced Cabinet Construction:

1. Bottoms and Ends of Cabinets, Shelves, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch (19-mm) plywood or veneer cors plywood, plastic-laminate faced on exposed surfaces, melamine faced on semiexposed surfaces.
2. Backs of Cabinets: Removable ¼ inch thick plywood or hardboard, plastic-laminate faced on exposed surfaces, melamine faced on semiexposed surfaces.
3. Drawer Fronts: 3/4-inch (19-mm) plywood, plastic-laminate faced on both sides.
4. Drawer Sides and Backs: 1/2-inch (12.7-mm) solid wood or plywood, with glued dovetail or multiple-dowel joints.
5. Drawer Bottoms: 1/2-inch (12.7-mm) plywood glued and dadoed into front, back, and sides of drawers.
6. Doors: 3/4-inch (19-mm) plywood or medium-density fiberboard with wood stiles and rails, plastic-laminate faced on both sides.
7. Shelves: Provide 1 inch thick plastic laminate shelves with veneers on all surfaces and edges on particle board or plywood.

B. Leg Shoes: Vinyl or rubber, black, open-bottom type.

C. Base Molding: ASTM F 1861, Type TP (rubber, thermoplastic) or TV (vinyl, thermoplastic), black, 4 inches (100 mm) high. Provide on fronts and exposed sides of free-standing floor-mounted cabinet casework.

1. Style: A, straight with no toe.

D. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

2.5 CASEWORK HARDWARE

A. Hardware, General: Provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware complying with requirements indicated.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Stainless-steel or Chrome-plated, semiconcealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 hinges for doors less than 48 inches (1220 mm) high and 3 hinges for doors more than 48 inches (1220 mm) high.

C. Pulls: Solid stainless-steel wire pulls, unless otherwise indicated, fastened from back with two screws. For sliding doors, provide recessed stainless-steel or chrome-plated flush-pulls. Provide 2 pulls for drawers more than 24 inches (600 mm) wide.

D. Door Catches: Zinc-plated, nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches (1220 mm) high.

E. Drawer Slides: Zinc-plated, metal-channel, self-closing drawer slides, designed to prevent rebound when drawers are closed, with nylon-tired, ball-bearing rollers, and complying with BHMA A156.9, Type B05091, and rated for the following loads:

1. Box Drawer Slides: **100 lbf (440 N)**.
2. File Drawer Slides: **200 lbf (890 N)**.
3. Pencil Drawer Slides: 45 lbf (200 N).
4. Keyboard Slide: 75 lbf (330 N).
5. Trash Bin Slides: **200 lbf (890 N)**.

F. Label Holders: Stainless steel, sized to receive standard label cards approximately 1 by 2 inches (25 by 51 mm), attached with screws or brads.

1. Provide on drawers, where indicated on Drawings.

G. Drawer and Cupboard Locks: Cylindrical (cam) type, 5-pin tumbler, brass with chrome-plated finish, complying with BHMA A156.11, Grade 1.
1. All locks in each classroom are to be keyed the same, each classroom keyed differently. Provide 3 keys per classroom and 5 master keys.

H. Sliding-Door Hardware Sets: Manufacturer's standard, to suit type and size of sliding-door units.

I. Adjustable Shelf Supports: 2-pin locking plastic shelf rests complying with BHMA A156.9, Type B04013, unless otherwise indicated on Drawings.

J. Adjustable Shelf Supports: Mortise-type, zinc-plated steel standards and shelf rests complying with BHMA A156.9, Types B04071 and B04091.

K. Doors and Drawers:

1. Provide “felt silencer” not more than 1/8 inch maximum thick.

2.6 COUNTERTOPS

A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch (25 mm) over base cabinets.

B. Plastic-Laminate Tops: Plastic-laminate sheet, shop bonded with waterproof glue to both sides of **3/4-inch (19-mm)** plywood or particleboard unless otherwise indicated.

1. Plastic-Laminate Type for Flat Tops: Type -HGS.
2. Plastic-Laminate Type for Formed Tops: Type -HGP.
3. Plastic-Laminate Type for Backing: Type -BKL.
4. Provide 3-mm PVC edging on front edge of top, on top edges of backsplashes and end splashes, and on ends of tops and splashes matching adjacent plastic-laminate surface colors.
5. Construct top and backsplash from one piece “post-formed” of plastic laminate with rolled edges and coved intersection. Provide separate end splashes fitted to top.
6. Use exterior plywood or phenolic-resin-bonded particleboard for countertops containing sinks.

C. Solid-Surfacing-Material Tops: Made from homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type -5 or Type -6, without a precoated finish.

D. Counter Tops and Backsplashes (Plastic Laminate):

1. Counter Tops – Perimeter edge-band with 1-1/2 inch thick plastic laminate over plywood core, thickness after lamination 1 inch. Shop fabricate tops using one-piece whenever possible and no transverse joints permitted with 24” of counter sinks.
   a. Front edge-band shall be rounded 3mm PVC strip flush with top counter surface and rounded underside flush with bottom of counter top matching adjacent plastic-laminate surface colors.
2. Exposed front corner edges of counter tops shall be rounded with ½” minimum and 1” maximum radius at corners when counter tops are not abutting walls.
   a. Island type counter tops: Provide ½” minimum to 1” maximum radius at all corners.
3. Backsplash and Ends: Provide 4” high backsplash unless otherwise noted, and ends on all counter units to match counter top for job site installation.
4. Contractor’s Option: “Post-formed” backsplashes and countertop front nosings will be reviewed for acceptability.

2.7 WALL SHELVING

A. Plastic-Laminate Shelving: Plastic-laminate sheet, Type HGL or HGP, shop bonded with waterproof glue to both sides of 3/4-inch (19-mm) particleboard, medium-density fiberboard or plywood.

1. Shelf Thickness: **3/4 inch (19 mm)** unless otherwise indicated.
2. Edge Treatment: Finish both edges with plastic laminate that matches face surfaces.

B. Adjustable Shelf Supports: Zinc-plated steel standards and shelf brackets, complying with BHMA A156.9, Types B04102 and B04112, surface mounted or mortise type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of institutional casework.

3.2 CASEWORK INSTALLATION

A. Install plumb, level, and true; shim as required, using concealed shims. Where institutional casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch (1.5 mm) of a single plane. Fasten cabinets to partition framing, wood blocking, or reinforcements in partitions with fasteners spaced 24 inches (600 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch (1.5 mm).

1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 inches (600 mm) o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.

C. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch (1.5 mm) of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Align similar adjoining doors to a tolerance of 1/16 inch (1.5 mm).

1. Fasten through back, near top and bottom, at ends, and not more than 16 inches (400 mm) o.c. directly to adequate structural supports.
2. Provide support information and items to other affected trades for early installation to partition cavities.

D. Install hardware uniformly and precisely. Set hinges snug and flat in mortises. Adjust and align hardware so moving parts operate freely and contact points meet accurately.

E. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF TOPS

A. Field Jointing: Where possible make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

B. Secure tops to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each front, end, and back.

C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

D. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and walls with adhesive.

E. Seal junctures of top, splash, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 INSTALLATION OF SHELVING

A. Securely fasten adjustable shelving supports to partition framing, wood blocking, or reinforcements in partitions.

B. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

3.5 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide plastic or other suitable water-resistant covering over countertop surfaces. Remove protection at Substantial Completion.

END OF SECTION 12 3210

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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 30 10 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 new non-elevated bleachers. New bleachers shall consist of two (2) such units, fthree (3) rows high x twenty-seven feet (27') in overall length and net seating capacity of 50 seats/unit. Seating count is based on 18" per seat and shall not include aisles.

1.2 QUALITY ASSURANCE AND WARRANTY GUARANTEE

A. The bleacher system shall be engineered by the manufacturer to meet the specific requirements of this project, as well as all applicable codes and regulations.

B. The system shall be designed by a registered professional Engineer and shall be certified by the manufacturer.

C. All components shall be provided by one manufacturer and shall be specifically designed for the use required of them. The bleacher shall be designed, fabricated and erected by the same manufacturer/supplier. The manufacturer supplier shall have at least five years experience in the manufacturing and erection of similar systems.

D. Warranty: Following proper installation, Contractor shall provide the following warranties:

1. 1 Years - Failure of structural strength in any component.
2. 5 Years - Anodized finish of seat plank.

1.3 BLEACHER DESIGN CRITERIA:

A. Applicable Codes. Michigan Building Codes 2009 Edition.
(*Except for Double Foot and Aisle Requirement.)

B. Design Loads:

1. Live Loads:
   Uniform Loading - Structure = 100 PSF
   Uniform Loading - Seat and Foot Planks = 120 PLF
2. Sway Loads:
   Perpendicular to Seats = 10 Pounds PFL
   Parallel to Seats = 24 Pounds PLF
3. Wind Loads:
   Basic Design Wind Speed = 100 MPH (Exposure "C")
   Horizontal 30 PSF (Minimum) of Vertical Projection
   Vertical 30 PSF (Minimum) of Horizontal Projection
   (*Note: All Bleachers must be anchored to meet wind loads specified above.)

C. Recommended Items to Meet Building Officials and Code Administrators (BOCA) 1993 Edition, not included with the Bleacher as specified:

1. Double Foot Plank: Shall consist of (2) such planks for seat rows 2 and up as described above.
2. Aisles: Aisle footboards shall be of all-aluminum with contrasting aisle markings. Three aisle stiffener angles shall be used to strengthen the aisle step. There shall be (1) aisle, 48" wide, located as required by the applicable codes defined below.
3. Aisle Handrails: Where there is seating on both sides of the aisle, handrails located within the aisle shall be discontinuous with gaps and breaks at intervals not exceeding 5 rows to facilitate access to seating and to permit crossing from one side of the aisle to the other. These gaps or breaks shall have a clear width of at least 22 inches, and not greater than 36 inches, measured horizontally. Where handrails are provided in the middle of aisle stairs, there shall be an intermediate handrail located approximately 12 inches below the main handrail. The handrail shall also have rounded terminations or bends.

1.4 SUBMITTALS

A. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project

B. Shop Drawings: Manufacturer to submit shop drawings sealed by a Michigan registered professional engineer and schedules for type, location, quantity, and details of steel and aluminum components required for project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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

1. Southern Bleacher Co., Inc.
P.O. Box One,
Graham, TX 76046
(800) 433-0912

2. All-Star Bleacher
6550 New Tampa Hwy.
Lakeland, FL 33801
(800) 875-3141

3. E & D Specialty Stands, Inc.
P.O. Box 700
North Collins, NY 14111
(800) 525-8515

4. National Recreations Systems
P.O. Box 11487
Fort Wayne, IN 46858
(219) 482-6023

5. Outdoor Aluminum
P.O. Box 118
Geneva, AL 36340
(800) 225-4249

6. Dant Corporation
P.O. Box 2655
Louisville, KY 40201-7408
(800) 626-2177

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.

2.2 UNDERSTRUCTURE

A. The understructure of each unit shall consist of a series of frames. Standard dimensions are 6" rise per row, 16" height of seats above foot plank, and 24" depth of row. Frames shall be galvanized angle, 6061-T6 alloy (or mechanically equivalent). Each frame shall be unit welded, using the metal inert has method by qualified welders, under guidelines established by the American Welding Society. Each frame shall consist of vertical, horizontal and diagonal bracing to

support the seat and foot planks as specified herein. Bolted or otherwise mechanical fastening of each frame's component will not be acceptable. All cross-bracing and horizontal bracing is to be aluminum angle 6061-T6 (or mechanically equivalent) and placed in number and location to sustain design loads.

2.3 SEAT PLANK

A. The seat plank shall be an aluminum, fluted, non-skid surface with decal flat NRS Part #P210AL, nominally 2" x 10", with actual cross-section dimensions of not less than 1.75" high x 9.5" wide, with a wall thickness nominally .078" for impact and deformation resistance. All seat plank shall be of aluminum alloy 6063-T6, and have a clear anodic coating (204R1) applied in accordance with AAS Standard AA-M10CZZA31.

2.4 FOOT PLANK

A. The foot plank shall be an aluminum, fluted, non-skid surface with decal flat NRS Part #P210ML nominally 2" x 10", footrest shall consist of one (1) such plank with actual cross-bracing dimensions of not less than 1.75: high x 9.5" wide, with a wall thickness nominally .078" for impact and deformation resistance. All foot planks shall be of aluminum alloy 6063-T6 and be of mill finish.

2.5 RISERS

A. Riser board shall be extruded anodized aluminum, 6063-T6 alloy, 1" x 8” nominal dimension.

2.6 ENDCAPS

A. Endcaps shall be of extruded aluminum 6063-T6 alloy, and have a clear anodic coating (204R1) applied in accordance with AAS Standard AA-M10C22A31. All endcaps are anodized and shall be field installed. Endcaps shall also be mechanically fastened on the underneath side of each plank with rivets and have smooth edges for safety.

2.7 CLIP SETS

A. Clip Sets shall adequately connect seat and foot planks to the supporting structure so as to transmit all design loads to the understructure members, as specified in the design section. All planks shall be connected to the supporting structure using four-way adjustable clips, carriage bolts and flange nuts of 5/16" steel and be hot-dipped galvanized.

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.

END OF SECTION 13 3515

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SECTION 20 0001 - MECHANICAL DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 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 unforseen significant non code compliance conditions of the existing installation they shall notify the Architect and Engineer immediately in writting.

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.

1.3 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

2.1 MATERIALS

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping and ductwork to be demolished serve only equipment and facilities within the demolition areas of the second floor.

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 assisitance of the construction manager (CM). The resoultion 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/enginnering design team.

D. Beginning of demolition means installer accepts existing conditions.

3.2 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.

3.3 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 hydronic water piping back to isolation valve.

E. Remove all supply, return and exhaust air ductwork back to main connection.

3.4 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

1.1 RELATED DOCUMENTS

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

1.2 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.

1.3 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.

1.4 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.

1.5 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, 2009.
   2. Michigan Plumbing Code, 2009.

1.6 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.

1.7 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.

1.8 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.

1.9 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

2.1 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. Sleves 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 with in the sleeve shall be sealed at each installation with a 3M approved sealant.

2.2 DIELECTRIC UNIONS

A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

2.3 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.

2.4 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

3.1 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 orderiy fashion.

E. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.2 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.

3.3 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.

3.4 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.

3.5 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.

3.6 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.

3.7 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.

3.8 FIRE STOPPING

A. Provide UL classified firestopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

3.9 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

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Basic electrical requirements for mechanical work.

PART 2 PRODUCTS

2.1 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.

2.2 QUALITY ASSURANCE

A. All electrical devices provided by Mechanical Trades, and all electrical devices furnished as part of the mechanical equipment shall be UnderwritersLaboratories (UL) listed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Pumps: Nameplates.

2.2 MANUFACTURERS

A. Brady Corp.

B. Champion-America, Inc.

C. Seton Identification Products.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.4 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.

2.5 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

3.1 PREPARATION

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

3.2 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.

3.3 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

1.1 SECTION INCLUDES

A. Piping insulation.

B. Lavatory Trim Covers

C. Jackets and accessories.

1.2 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2013.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2013.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2012.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

H. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2007.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2013.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 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:
   1. Vapor Barrier Lap Adhesive shall be compatible with the insulation and as recommended by the insulation manufacturer

F. Insulating Cement/Mastic:
   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.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION (FECI)

A. Manufacturer:

1. Armacell LLC: www.armacell.us.
2. Rubatex
3. Imcoa Self Sealing "Imcolock" or unslit "Imcoshield" (Polyolefin).

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive or hot melt fuse seal joining method used with Polyolefin insulation. Compatible with insulation and as recommended by the insulation manufacturer.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation; Model 2000: www.jm.com.
      b. Protto
      c. Ceelco
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with 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.

3.3 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.

B. HVAC Systems:
1. Hot Water Heating:
a. Glass Fiber Insulation:
1) Pipe Size Range: 1-6 inch.
(a) Thickness: 1 inch.
b. FECI:
1) Pipe Size Range: 1-6 inch.
(a) Thickness: 1 inch.
2. Condensate Drains from Cooling Coils:
a. Glass Fiber Insulation:
1) Pipe Size Range: 1-4 inch.
(a) Thickness: 1 inch.
b. FECI:
1) Pipe Size Range: 1-4 inch.
(a) Thickness: 1 inch.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Gas.

1.2 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.

1.3 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.

1.4 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.

1.5 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 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.

2.2 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.

2.3 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.

2.4 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), 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.

2.5 STORM WATER 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: Neoprene gaskets 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.

2.6 STORM WATER 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: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.7 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: NFPA 54, threaded or welded to ASME B31.1.

2.8 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.

2.9 GLOBE VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.apollovalves.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 3 Inches:
   1. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder ends.

C. 2 Inches and Larger:
   1. MSS SP-85, 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.

2.10 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: 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.

2.11 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.

2.12 SWING CHECK VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Hammond Valve: www.hammondvalve.com.
3. Nibco, Inc: www.nibco.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up to 2 Inches:
1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

C. Over 2 Inches:
1. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.13 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Hammond Valve: www.hammondvalve.com.
3. Crane Co.: www.cranevalve.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.14 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. Green Country Filter Manufacturing: www.greencountryfilter.com.
3. WEAMCO: www.weamco.com.

B. Size 2 inch and Under:
1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2. Class 150, 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

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 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. Refer to Section 22 0719.

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. Refer to Section 09 9000. 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.

3.4 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 ball 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.

3.5 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.

3.6 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.

3.7 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.
   2. Plastic Piping:
      a. All Sizes:

1) Maximum hanger spacing: 6 ft.
2) Hanger rod diameter: 3/8 inch.

END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pumps.
   1. Sump Pumps.

1.2 REFERENCE STANDARDS

A. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; 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

1.3 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. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 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.

1.5 CERTIFICATIONS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 WARRANTY

A. Provide five year manufacturer warranty for sump pumps.

PART 2 PRODUCTS

2.1 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.

2.2 SUMP PUMPS

A. Type: Vertical centrifugal, direct connected, simplex arrangement.

B. Casing: Cast iron volute with radial clearance around impeller, inlet strainer, slide away couplings.

C. Impeller: Cast iron; open non-clog, keyed to corrosion resistant alloy steel shaft.

D. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.

E. Bearings: Forced grease lubricated bronze sleeve spaced maximum 48 inches and grease lubricated ball thrust at floor plate.

F. Drive: Flexible coupling to vertical, solid shaft ball bearing electric motor.

G. Sump: Steel cover plate with steel curb frame for grouting into concrete sump with inspection opening and cover, and alarm fittings.

H. Controls (Simplex): Float switch with float rod, stops, and corrosion resistant float, and separate pressure switch high level alarm with transformer, alarm bell and stand-pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Pumps:

1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets

B. Dual flush water closets.

C. Urinals

D. Waterless urinals.

E. Lavatories

F. Sinks

G. Service Sinks

H. Garbage Disposals

I. Electric Water Coolers

1.2 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.

1.3 QUALITY ASSURANCE

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

1.4 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.5 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.

1.6 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

C. Supply two sets of faucet washers.

PART 2 PRODUCTS

2.1 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.

2.2 FLUSH VALVE WATER CLOSETS (WC-1) **REFER TO PLUMBING FIXTURE SCHEDULE ON PLANS**

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 diltered 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; Model 9500c.

c. Centoco.
d. 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. 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.

2.3 WALL HUNG URINALS (UR-1) **REFER TO PLUMBING FIXTURE SCHEDULE ON PLANS**

A. Wall Hung Urinal Manufacturers:

1. Sloan.
2. American Standard Inc.
3. Kohler.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.

1. Flush Volume: 1.0 gallon, 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; Model "Optima Plus" 8186.
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 diltered 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.
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.

2.4 LAVATORIES (LAV-1) REFER TO PLUMBING FIXTURE SCHEDULE ON PLANS

A. Manufacturers:

1. American Standard; Model "Roxalyn" 195.073 (Vitreous Wall Hung).
2. Kohler.
3. Zurn.
4. Sloan

B. Vitreous China Wall Hung Basin:

1. ASME A112.19.2M; vitreous china wall hung lavatory 19 x 17 inch minimum, rectangular basin with splash lip, front overflow, and soap depression.

C. Supply Faucet Manufacturers:

1. American Standard Inc; Model 7881.732 "Hampton": www.americanstandard.com..
2. Delta; Model 22C121.
3. Elkay.
4. Kohler.
5. Symmons;.

D. Supply Faucet:

1. ASME A112.18.1M; chrome plated supply fitting with open grid strainer, water economy aerator with maximum 1.5 GPM flow, single lever handle.

E. Supply Faucet - Sensor Operated:

1. ADA Compliant, Sensor activated, 24 VAC, Chrome Plated Brass, Hand Washing Faucet with the following features Splash-proof Circuit Control Module, Sensor Range Adjustment Screw, Trouble Shooting LED Indicator Lights, User friendly Variable Time Out Settings, Filtered Solenoid Valve with serviceable "Y" Strainer Filter, 120 VAC/24 VAC Transformer (Plug-in or Box Mount), Vandal resistant Spray Head with Pressure Compensating Flow

Control, Metal Jacket wire protection for Sensor and Solenoid Leads, Matching Trim Plate for 4" Center-Set sink, Modular Quick-Release Sensor and Solenoid Connections. Provide ASSE 1070 mixing valve for each faucet. Provide with 1 accessory EL-154 Transformer 120 VAC/24 VAC per 3 faucets.

2. ASME A112.18.1M; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, spray and cover plate, open grid strainer.

F. Accessories:
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Carrier:
   a. Manufacturers:
      1) JOSAM Company.
      2) J.R. Smith.
      3) Wade.
      4) Sloan Valve Company.
      5) Zurn Industries, Inc..
   b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.5 SINKS (SK-1) REFER TO PLUMBING FIXTURE SCHEDULE ON PLANS

A. Manufacturers:
1. American Standard.
2. Just.
3. Elkay; Model LRAD2521.
4. Substitutions: See Section 01600 - Product Requirements.

B. Single Compartment Bowl: ADA Compliant
1. ASME A112.19.3M; 25 x 21 x 6 1/2 inch outside dimensions, 18 gage thick, Type 304 stainless steel, self-rimming and undercoated, with ledge back, and drilled holes for 4" on center trim.
   a. Drain: 3 inch chromed brass drain.

C. Double Compartment Bowl: ADA Compliant
1. ASME A112.19.3M; 33 x 21 1/4 x 6 inch outside dimensions 20 gage thick, Type 302 stainless steel, self-rimming and undercoated, with ledge back drilled for trim.
2. ASME A112.19.3M; [33] x [21 1/4] x [6] inch outside dimensions 18 gage thick, Type 302 stainless steel, Offset drains, self-rimming and undercoated with heavy duty sound guard, with ledge back drilled for trim.
   a. Drain: 1-1/2 inch chromed brass drain.
   b. Drain: 3-1/2 inch crumb cup and tailpiece.

D. Classroom Drinking Fountain With Sink: ADA Compliant
1. ASME A112.19.3M; 37 1/4 x 17 x 7 1/2 inch outside dimensions 18 gage thick, type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.

E. Supply Faucet Manufacturers:
   1. Elkay
   2. Kohler
   3. Delta
   4. Just

F. Supply Faucet:
   1. ASME A112.18.1M; chrome plated supply fitting with water economy aerator with maximum 1.5 gpm flow, wrist blade handles, 6 inch radius goosneck 10.5 inch height, .090 inch spout wall thickness. Include vandal resistant features and screws.

G. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver stop, rigid supplies.

H. Bubbler: Chrome plated pushbutton bubbler with Flexi-guard, ADA Compliant. Equivalent to Elkay model LK-1141-A.

I. Garbage Disposal
   1. Provide Garbage Disposal for SK-1. Coordinate which drain to install dispoal in with Architect.
      a. Garbage disposal shall have stainless steel grind chamber, continuous feed, automatic reversing action with 1.0 HP 120V split phase motor and 7 year parts and service warranty.
      b. Approved manufacturer:
         1) In-Sink-Erator Model "Evolution Excel"

2.6 GARBAGE DISPOSAL (REFER TO PLUMBING FIXTURE SCHEDULE ACCESSORIES ON PLANS)

A. Gargabe Disposal
   1. Provide Garbage Disposal for each SK. Coordinate which side of double compartment sink shall receive the garbage disposal with Architect.
   2. Garbage disposal shall have stainless steel grind chamber, continuous feed, automatic reversing action with 1 HP 120V split phase motor and 7 year parts and service warranty.
   3. Approved manufacturer:
      a. In-Sink-Erator Model "Evolution Excel"
   4. Substitutions: See Section 01600 - Product Requirements.

2.7 DRINKING FOUNTAINS - REFER TO PLUMBING FIXTURE SCHEDULE ON PLANS

A. Drinking Fountain Manufacturers:
   1. Elkay Manufacturing Company: www.elkay.com.
   2. Most Dependable Fountain; Model 450 SS.
   3. Haws Corporation: www.hawsco.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.8 ELECTRIC WATER COOLERS (EWC) - REFER TO PLUMBING FIXTURE SCHEDULE ON PLANS

A. Manufacturers:
   1. Elkay Manufacturing Co.; Model EBFATL-8.
   2. Oasis Manufacturing Co.; Model #P8ACSL.
   3. Sunroc Manufacturing Co.; Model #ADAD8RB.
   4. Haws Drinking Faucet Company.
   5. Substitutions: See Section 01600 - Product Requirements.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 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.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 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.

3.8 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Water Closet Flush Valves:
      a. Standard: 11 inches min. above bowl rim.
   2. Water Closet:
      a. Standard: 15 inches to top of bowl rim.
      b. Accessible: 18 inches to top of seat.
   3. Urinal:
      a. Standard: 22 inches to top of bowl rim.
      b. Accessible: 17 inches to top of bowl rim.
   4. 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: 1 Inch.
      b. Cold Water: 3/4 Inch.
      c. Waste: 2 Inch.
      d. Vent: 1-1/2 Inch.
   3. Lavatory: LAV-1
      a. Hot Water: 1/2 Inch.
      b. Cold Water: 1/2 Inch.
      c. Waste: 2 Inch.
      d. Vent: 1-1/2 Inch.
   4. Service Sink: SS-1

a. Hot Water: 3/4 Inch.
b. Cold Water: 3/4 Inch.
c. Waste: 3 Inch.

5. Electric Water Cooler: EWC-1
   a. Cold Water: 1/2 Inch.
   b. Waste: 1 1/2 Inch.
6. 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 0519 - METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.2 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers:
   1. Miljoco Corporation: www.miljoco.com.
   2. H.O. Trerice Co.:www.trerice.com.
   3. Dwyer Instruments, Inc: www.dwyer-inst.com.
   4. Moeller Instrument Co., Inc: www.moellerinstrument.com.
   5. 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.

2.2 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Miljoco Corporation: www.miljoco.com.

2. H.O. Trerice Co.:www.trerice.com.
3. Dwyer Instruments, Inc: www.dwyer-inst.com.
4. Omega Engineering, Inc: www.omega.com.
5. Weksler Glass Thermometer Corp: www.wekslerglass.com.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 12 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.5 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

C. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.

PART 3 EXECUTION

3.1 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. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 23 0943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

I. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Vibration isolators.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Isolation Technology, Inc: www.isolationtech.com.

B. Kinetics Noise Control, Inc: www.kineticsnoise.com.

C. Mason Industries: www.mason-ind.com.

2.2 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
   2. Steel springs to function without undue stress or overloading.

2.3 EQUIPMENT SUPPORT BASES

2.4 VIBRATION ISOLATORS

2.5 VIBRATION ISOLATORS

A. Spring Hangers:
   1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
   3. Misalignment: Capable of 20 degree hanger rod misalignment.

B. Neoprene Pad Isolators:
   1. Rubber or neoprene waffle pads.
      a. Hardness: 30 durometer.
      b. Thickness: Minimum 1/2 inch.
      c. Maximum Loading: 50 psi.
      d. Rib Height: Maximum 0.7 times width.

2. Configuration: Single layer.

C. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

3.3 SCHEDULE

A. Equipment Isolation Schedule.
   1. Indoor Water Source Heat Pumps (Floor Mounted):
      a. Isolator Type: Neoprene Pad Isolators
      b. Pad isolator shall be sized to cover the entire bottom of the unit. Corner only pads are not acceptable.
   2. Indoor Water Source Heat Pumps (Ceiling Hung):
      a. Isolator Type: Spring Hangers

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 PIPE MARKERS

A. Color: Conform to 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.

C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

A. Install 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 pipe markers 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 air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify thermostats relating to terminal boxes or valves with nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units and radiator valves with numbered tags.

J. Identify piping, concealed or exposed, with plastic 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.

END OF SECTION

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

1.2 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Strategic Energy Solutions, Inc. and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC MN-1, AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Certified by one of the following:
   a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
   b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
   c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Strategic Energy Solutions, Inc. to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

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. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. 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.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. 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.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

1.2 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 GLASS FIBER, FLEXIBLE WRAP

A. Manufacturer:
   1. Knauf Insulation; Model Knauf Duct Wrap with FSK: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.31 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Insulation shall be 1.5 lb/cu. ft. density. Refer to Schedule below for thickness.

D. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with pressure sensitive tape.

E. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

F. Tie Wire: Annealed steel, 16 gage.

2.3 DUCT LINER

A. Manufacturers:
1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp; Model Fiberglas Duct Liner Board: www.owenscorning.com.

B. Insulation: ASTM C 1071; flexible, noncombustible blanket with poly vinyl acetate polymer impregnated surface and edge coat.
1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
2. Service Temperature: Up to 250 degrees F.
3. Minimum Noise Reduction Coefficients:
4. 1 inch Thickness: 0.45.

C. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
1. Density: 1.5 lb/cu ft
2. Liner shall meet Anti-Bacterial Requirements of ASTM C 1071, ASTM G 21 and ASTM G 22
3. Liner shall be cleanable in accordance with NAIMA "Duct Cleaning Guide."

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been pressure and leak tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls penetrtions and at hanger connections.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

E. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

F. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
   6. Provide nosing on all exposed fibergalss edges.

3.3 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:
   1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

B. Relief Ducts Within 10 ft of Exterior Openings:
   1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

C. Outside Air Intake Ducts:
   1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

D. Outside Air and Exhaust Air Plenums:
   1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

E. Return Air Ductwork (located in plenum/conditioned space):
   1. Duct Liner: 1 inches thick (first ten feet only) from unit.

F. Supply Ductwork (in unconditioned space):
   1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

G. Supply Ductwork (located exposed in conditioned space):

1. No Insulation Required

END OF SECTION

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.5 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 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. Maximum service temperature: 850 degrees F.
   2. Maximum moisture absorption: 0.2 percent by volume.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

E. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

F. Indoor Vapor Barrier Finish:
   1. Vinyl emulsion type acrylic, compatible with insulation, black color.

G. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.3 HYDROUS CALCIUM SILICATE

A. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.
   1. 'K' value: ASTM C177 and C518; 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum service temperature: 1200 degrees F.
   3. Density: 15 lb/cu ft.

B. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

2.5 JACKETS

A. PVC Plastic.
   1. 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.
   2. Covering Adhesive Mastic:
      a. Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. 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.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without 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.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

3.3 SCHEDULE

A. HVAC Equipment Condensate Drains:
   1. Pipe Size Range: 3/4-4 inch
      a. Thickness: 1 inch

B. Heating Systems:
   1. Heating Water Supply and Return:
      a. Thickness: 1.5"
      b. Jacket: PVC when exposed

C. Cooling Systems:
   1. Refrigerant Suction: 1" FECI
      a. UV Coating when outside
   2. Refrigerant Hot Gas: 1" FECI
      a. UV Coating when outside

END OF SECTION

SECTION 23 0913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thermostats.

B. Control valves.

C. Automatic dampers.

D. Damper operators.

1.2 SUBMITTALS

A. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

1.3 QUALITY ASSURANCE

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

1.4 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

C. Provide five year manufacturer's warranty for control air compressors.

PART 2 PRODUCTS

2.1 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.2 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enamelled finished face panel.

C. Provide common keying for all panels.

2.3 CONTROL VALVES

A. Globe Pattern:
   1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
   2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
   3. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.
      b. Replaceable plugs and seats of stainless steel.
      c. Size for 3 psig maximum pressure drop at design flow rate.
      d. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.

B. Butterfly Pattern:
   1. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F wafer or lug ends, extended neck.
   2. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.
      b. Size for 1 psig maximum pressure drop at design flow rate.

C. Electronic Operators:
   1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
   2. Select operator for full shut off at maximum pump differential pressure.

2.4 DAMPERS

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.

C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Oil impregnated sintered bronze.

G. Linkage Bearings: Oil impregnated sintered bronze.

H. Leakage: Less than one percent based on approach velocity of 2000 ft/min and 4 inches wg.

I. Maximum Pressure Differential: 6 inches wg.

J. Temperature Limits: -40 to 200 degrees F.

2.5 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:
   1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.6 THERMOSTATS

A. Electric Room Thermostats:
   1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
   2. Service: cooling only.
   3. Covers: Locking with set point adjustment, with thermometer.

B. Line Voltage Thermostats:
   1. Integral manual On/Off/Auto selector switch, single or two pole as required.
   2. Dead band: Maximum 2 degrees F.
   3. Cover: Locking with set point adjustment, with thermometer.
   4. Rating: Motor load.

C. Room Thermostat Accessories:
   1. Thermostat Covers: Vandal proof clear plastic.
   2. Insulating Bases: For thermostats located on exterior walls.

D. Outdoor Reset Thermostat:
   1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
   2. Scale range: -10 to 70 degrees F.

E. Airstream Thermostats:
   1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
   2. Averaging service remote bulb element: 7.5 feet.

F. Electric Low Limit Duct Thermostat:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,

2. Bulb length: Minimum 20 feet.
3. Provide one thermostat for every 20 sq ft of coil surface.

G. Electric High Limit Duct Thermostat:
1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above setpoint,
2. Bulb length: Minimum 20 feet.
3. Provide one thermostat for every 20 sq ft of coil surface.

H. Fire Thermostats:
1. UL labeled, factory set in accordance with NFPA 90A.
2. Normally closed contacts, manual reset.

I. Heating/Cooling Valve Top Thermostats:
1. Proportional acting for proportional flow, molded rubber diaphragm, remote bulb liquid filled element, direct and reverse acting at differential pressure to 25 psig, cast housing with position indicator and adjusting knob.

2.7 TRANSMITTERS

A. Temperature Transmitters:
1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degree F span and plus or minus 1 percent for 50 degree F span, with 50 degrees F temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 2726.

C. Mount freeze protection thermostats using flanges and element holders.

D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

E. Provide guards on thermostats in entrances.

F. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors. Provide separate minimum outside air damper section adjacent to return air dampers with separate damper motor.

G. Provide isolation (two position) dampers of parallel blade construction.

H. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

I. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

J. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

K. Provide conduit and electrical wiring in accordance with Section 26 2717. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION

SECTION 23 0925 - DIRECT-DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1: GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Control Equipment

B. Software

1.3 RELATED SECTIONS

A. The following sections constitute related work:
   1. Section 23 0553 - Identification for HVAC Piping and Equipment
   2. Section 23 0810 - HVAC Commissioning Requirements
   3. Section 23 0913 - Instrumentation and Control Devices for HVAC
   4. Section 23 2123 - Hydronic Pumps
   5. Section 23 3300 - Air Duct Accessories
   6. Section 23 3423 - HVAC Power Ventilators
   7. Section 23 5233.13 - Finned-Tube Boilers
   8. Section 23 7210 - Energy Recovery Ventilators
   9. Section 23 7413 - Packaged Central-Station Air Handling Units
   10. Section 23 7520 - Custom Water Source Heat Pumps
   11. Section 23 8148 - Water Source Heat Pumps

1.4 REFERANCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.

1.5 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 0913 - Sensors and Transmitters:
   1. Airflow stations
   2. Flow switches
   3. Press and temp sensor wells & sockets
   4. Temp sensor wells and sockets

B. Section 23 0913 - Control Valves:
   1. Control valves

C. Section 23 0913 - Control Dampers:

1. Automated Dampers

D. Section 23 7000 - Central HVAC Equipment:
   1. Energy Recovery Ventilators
   2. Custom Water Source Heat Pumps

E. Section 23 8000 - Decentralized HVAC Equipment:
   1. Terminal unit controls

1.6 PRODUCT INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 23 0913 - Sensors and Transmitters:
   1. Duct static pressure sensors
   2. H2O Pressure Differential/Flow Switches

B. Section 28 3100 - Fire Detection and Alarm:
   1. Smoke Detectors/Fire Stats

1.7 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. General:
   1. Coordination Meeting: The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting.

B. Section 23 5200 - Heating Boilers:
   1. Boiler controls: The boiler vendor shall furnish boilers with an interface to the control and monitoring points indicated on the drawings. These specified points shall be the minimum acceptable interface to the boiler. The connection to these points shall be by one of the following methods:
      a. Hardwired connection such as relay, 0-10VDC, or 4-20mA
      b. Open protocol network connection

C. Section 23 8000 - Decentralized HVAC Equipment:
   1. Unit ventilators, unit heaters, fan coils, etc.: Unit ventilators, unit heaters, fan coils, cabinet heaters, convective or fin tube heaters, zone reheat, and similar terminal units: These units shall be furnished configured to accept control inputs from an external building automation system controller. Factory mounted safeties and other controls shall not interfere with this controller.

D. Section 26 2900 - Low-Voltage Controllers:

1. Variable frequency drives: The variable frequency drive (VFD) vendor shall furnish VFDs with an interface to the control and monitoring points indicated on the drawings. These points shall be the minimum acceptable interface to the VFD. The connection to these points shall be by one of the following methods:
   a. Hardwired connection such as relay, 0-10VDC, or 4-20mA
   b. Open protocol network connection

E. Communications with Third Party Equipment:

1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a open protocol network interface for integration into the Direct Digital Control System described in this section.

1.8 DESCRIPTION

A. The control system for this project shall consist of a web-based direct-digital control (DDC) system. The new system shall be coordinated with the existing web-based control system. The new controls for this project shall be integrated into the existing Server Software and all custom graphics shall match the owner's existing system graphics.

1. For reference: the existing DDC server software is Johnson Controls Inc. - Facility Explorer.

B. The system shall directly control HVAC equipment as detailed on the drawings. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints as specified in the sequence.

C. System shall use open protocol communications to the operator workstation or web server and for communication between control modules.

1.9 APPROVED CONTROL SYSTEMS

A. Base Bid system manufacturer:

1. Johnson Controls: www.jci.com

B. Base Bid constrol system installer:

1. Mechanical Comfort, Inc.

C. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.

1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless the Owner approves use of multiple manufacturers.

1.10 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with the Control System Manufacturer.

2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

B. Perform work in accordance with NFPA 70.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.11 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
   1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
   2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
   3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
   4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
   5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
   6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
   7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
   8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
   9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy as listed below:
      a. Space Temperature: +/- 1 degrees F
      b. Ducted Air: +/- 1 degrees F
      c. Outside Air: +/- 2 degrees F
      d. Dew Point: +/- 3 degrees F
      e. Water Temperature: +/- 1 degrees F
      f. Delta-T: +/- 0.25 degrees F
      g. Relative Humidity: +/- 5% RH
      h. Water Flow: +/- 2% of full scale
      i. Airflow (terminal): +/- 10% of full scale
         1) Accuracy applies to 10% - 100% of scale
      j. Airflow (measuring stations): +/- 5% of full scale
      k. Air Pressure (ducts): +/- 0.1 in. w.g.
      l. Air Pressure (space): +/- 0.01 in. w.g.
      m. Water Pressure: +/- 2% of full scale
         1) For both absolute and differential pressure
      n. Electrical (A, V, W, Power Factor): +/- 1% of reading
         1) Not including utility supplied meters

o. Carbon Monoxide (CO): +/- 5% of reading
p. Carbon Dioxide (CO2): +/- 50 ppm

10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances as listed below:
    a. Air Pressure (0 to 6 in. w.g.): +/- 0.2 in. w.g.
    b. Air Pressure (-0.1 to 0.1 in. w.g.): +/- 0.01 in. w.g.
    c. Airflow: +/-10% of full scale
    d. Space Temperature: +/- 2.0 degrees F
    e. Duct Temperature: +/- 3 degrees F
    f. Humidity: +/- 5% RH
    g. Fluid Pressure (1 to 150 psi): +/- 1.5 psi
    h. Fluid Pressure (0 to 50 in. w.g. differential): +/- 1.0 in. w.g.

1.12 SUBMITTALS

A. Direct Digital Control System Hardware
    1. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
    2. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
        a. Direct digital controllers (controller panels)
        b. Transducers and transmitters
        c. Sensors (include accuracy data)
        d. Actuators
        e. Valves
        f. Relays and switches
        g. Control panels
        h. Power supplies
        i. Batteries
        j. Operator interface equipment
        k. Wiring
    3. Wiring diagrams and layouts for each control panel. Show termination numbers.
    4. Floor plan schematic diagrams indicating field sensor and controller locations.
    5. Riser diagrams showing control network layout, communication protocol, and wire types.

B. Central System Hardware and Software
    1. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.
    2. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
        a. Central Processing Unit (CPU) or web server
        b. Monitors
        c. Keyboards
        d. Power supplies
        e. Battery backups
        f. Interface equipment between CPU or server and control panels
        g. Operating System software
        h. Operator interface software
        i. Color graphic software

j. Third-party software

3. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
4. Network riser diagrams of wiring between central control unit and control panels.

C. Controlled Systems
1. Riser diagrams showing control network layout, communication protocol, and wire types.
2. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
3. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
4. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
5. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.

D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.13 WARRANTY

A. Warrant work as follows:
1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
4. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.14 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics
2. Record drawings
3. Database
4. Application programming code
5. Documentation

PART 2: PRODUCTS

2.1 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNITCATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise an open protocol internetwork.

B. Install new wiring and network devices as required to provide a complete and workable control network.

C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
   1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
   2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

E. Controllers with real-time clocks shall synchronize with the building management system. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.

F. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

G. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher.

Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.

1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.
2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
3. For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.
4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

2.3 OPERATOR INTERFACE

A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. In addition to the primary operator interface, the system shall include a secondary interface compatible with a locally available commercial wireless network and viewable on a commercially available wireless device such as a Wireless Access Protocol (WAP) enabled cellular telephone or personal digital assistant (PDA). This secondary interface may be text-based and shall provide a summary of the most important data. As a minimum, the following capabilities shall be provided through this interface:

1. An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.
2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.
3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.
4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.

B. Communication. Web server or workstation and controllers shall communicate using an open protocol communications language. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol.

C. Hardware. Each workstation or web server shall consist of the following:

1. Hardware Base. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times as specified. Hard disk shall have sufficient memory to store system software, one year of data for trended points, and a system database at least twice the size of the existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance. Web server or workstations shall be IBM-compatible PCs with a minimum of:
   a. Intel Pentium 2.66 GHz processor

b. 1 GB RAM
c. 40 GB hard disk providing data at 100 MB/sec
d. 48x CD-ROM drive
e. Serial, parallel, and network communication ports and cables required for proper system operation

2. Modem. Auto-dial modem and associated cables shall transmit over voice-grade telephone lines at a nominal 56,000 baud and shall provide communication between workstation or web server and remote buildings and workstations.

D. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1. Log In and Log Out. System shall require user name and password to log in to operator interface.
2. Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.
3. View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.
4. View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.
5. View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.
6. View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.
7. View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.
8. Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.
9. Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

E. System Software.

1. Operating System. Web server shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows XP Pro, Red Hat Linux, or Sun Solaris. Coordinate operating system type with the Owner.
2. System Graphics. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
   a. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment,

to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

b. Animation. Graphics shall be able to animate by displaying different image files for changed object status.

c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

F. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. Operators shall be able to configure the system.

4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.

5. Security. System shall require a user name and password to view, edit, add, or delete data.

   a. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.

   b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.

   c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

6. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as detailed on the drawings.

8. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.

9. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.
11. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk.
12. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.
13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
14. Standard Reports. Furnish the following standard system reports:
    a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
    b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
    c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
        1) Alarm History.
        2) Trend Data. Operator shall be able to select trends to be logged.
        3) Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.
15. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.
16. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.
17. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.
18. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:
    a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.
    b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.
e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.
g. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.
    1) Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.
    2) System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

G. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

2.4 CONTROLLER SOFTWARE

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. Scheduling. System shall provide the following schedule options as a minimum:
    1. Weekly. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
    2. Exception. Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.
    3. Holiday. Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

C. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

D. Binary and Analog Alarms. See Paragraph 2.3.F.7 (Alarm Processing).

E. Alarm Reporting. See Paragraph 2.3.F.9 (Alarm Reactions).

F. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

G. Maintenance Management. System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits.

H. Sequencing. Application software shall sequence chillers, boilers, and pumps as detailed on the drawings.

I. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.

J. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

K. Energy Calculations.
   1. System shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
   2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

L. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

M. On and Off Control with Differential. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.

N. Runtime Totalization. System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit.

2.5 CONTROLLERS

A. General. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified.

B. Communication.
   1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.

2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation. Each piece of equipment specified shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

C. Environment. Controller hardware shall be suitable for anticipated ambient conditions.
1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

D. Keypad. Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.

E. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

F. Serviceability.
1. Controllers shall have diagnostic LEDs for power, communication, and processor.
2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Memory.
1. Controller memory shall support operating system, database, and programming requirements.
2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

H. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

I. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
   a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
   b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
2. Dielectric strength of 1000 V minimum
3. Response time of 10 nanoseconds or less
4. Transverse mode noise attenuation of 65 dB or greater
5. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.8 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers.

1. Type. Control dampers shall have linear flow characteristics and shall be parallel- or opposed-blade type as specified below or as scheduled on drawings.
   a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
   b. Other modulating dampers shall be opposed-blade.
   c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.
2. Frame. Damper frames shall be 2.38 mm (13 gauge) galvanized steel channel or 3.175 mm (1/8 in.) extruded aluminum with reinforced corner bracing.
3. Blades. Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16 gauge).
4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s·m2 (10 cfm per ft2) at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).
6. Sections. Damper sections shall not exceed 125 cm - 150 cm (48 in. - 60 in.). Each section shall have at least one damper actuator.
7. Linkages. Dampers shall have exposed linkages.

B. Electric Damper and Valve Actuators.

1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank.

C. Control Valves.

1. General. Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown.
2. Type. Provide two- or three-way control valves for two-position or modulating service as shown.
3. Water Valves.
   a. Valves providing two-position service shall be quick opening. Two-way valves shall have replaceable disc or ball.
   b. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide the following minimum close-off pressure ratings.
      1) Two-way: 150% of total system (pump) head.
      2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
   c. Ports. Valves providing modulating service shall have equal percentage ports.
   d. Sizing.
      1) Two-position service: line size.
      2) Two-way modulating service: select pressure drop equal to the greatest of twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35 kPa (5 psi).
      3) Three-way modulating service: select pressure drop equal to the smaller of twice the pressure drop through the coil exchanger (load) or 35 kPa (5 psi).
   e. Fail Position. Water valves shall fail normally open or closed as follows unless otherwise specified.
      1) Water zone valves: normally open.
      2) Heating coils in air handlers: normally open.
      3) Chilled water control valves: normally closed.
      4) Other applications: as scheduled or as required by sequences of operation.

D. Binary Temperature Devices.

1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
2. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

E. Temperature Sensors.

1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m 2(10 ft 2) of duct cross-section.
3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
4. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.
5. Differential Sensors. Provide matched sensors for differential temperature measurement.

F. Flow Switches. Flow-proving switches shall be paddle (water service only) or differential pressure type (air or water service) as shown. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).

1. Paddle switches shall have adjustable sensitivity and NEMA 1 enclosure unless otherwise specified.
2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

G. Relays.

1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

H. Override Timers.

1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0-6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.

I. Current Transmitters.

1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

J. Current Transformers.

1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

K. Voltage Transmitters.

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.
2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

L. Voltage Transformers.

1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

M. Power Monitors.

1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.
2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

N. Current Switches.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

O. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

P. Local Control Panels.

1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.
2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.
3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

2.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

2.10 FIBER OPTIC CABLE SYSTEM

A. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.

B. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

PART 3: EXECUTION

3.1 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 09 23 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 PROTECTION

A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site.
   1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
   2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance.
   1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
   2. Train Test and Balance Contractor to use control system interface tools.
   3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
   4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

C. Life Safety.

1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as indicated on drawings.
2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as indicated on drawings.
3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.

D. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.
1. Communication media and equipment shall be provided as specified.
2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation detailed on the drawings.
3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.5 FILED QUALITY CONTROL

A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances.

B. Continually monitor field installation for code compliance and workmanship quality.

C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.6 EXISTING EQUIPMENT

A. Wiring. Existing wiring may be re-used as much as possible. Check wire integrity and ensure proper application to installation. Identify and test reused wires according to this specification. Properly identify unused or redundant wiring.

B. Local Control Panels. Existing local control panels may be used to locate new equipment. Remove and deliver redundant and unused equipment to Owner. Patch panel face cover to fill holes caused by removal of unused equipment. Relocate panels as shown.

C. Repair. Unless otherwise directed, Contractor is not responsible for repair or replacement of existing energy equipment and systems, valves, dampers, or actuators. Notify Engineer in writing immediately of existing equipment that requires maintenance.

D. Temperature Sensor Wells. Existing temperature sensor wells in piping may be reused. Modify wells as required for proper fit of new sensors.

E. Indicator Gauges. Ensure operation of and recalibrate for reasonable accuracy or replace existing gauges.

F. Damper Actuators, Linkages, and Appurtenances: Existing damper actuators, linkages, and appurtenances may be reused unless specifically noted otherwise. Remove and deliver unnecessary equipment to Owner.

G. Control Valves. Existing control valves may be reused unless specifically noted otherwise.

H. Existing System Operating Schedule. Existing mechanical system may be disabled during this work.

I. Maintain fan scheduling using existing or temporary time clocks or control systems throughout the control system installation.

J. Modify existing starter control circuits if necessary to provide hand-off-auto control of each controlled starter. Furnish new starters or starter control packages as required.

K. Patch holes and finish to match existing walls.

L. At Owner's request, items to be delivered to Owner shall instead be properly disposed of. Hazardous materials shall be disposed of under Division 02.

3.7 WIRING

A. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 23 differ from Division 26, Section 23 09 23 shall take precedence.

B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.

D. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

E. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.

F. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

G. Do not install wiring in raceway containing tubing.

H. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.

I. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

J. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

K. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

L. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

M. Use color-coded conductors throughout.

N. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

O. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

P. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

Q. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

R. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

S. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

T. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.8 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring.

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

G. Label communication wiring to indicate origination and destination.

H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.9 FIBER OPTIC CABLE

A. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

3.10 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m2 (1 ft2) of coil area.

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall at designated location with sun shield.

I. Differential Air Static Pressure.

1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.
4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.

J. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.11 3.12 ACTUATORS

A. General. Mount actuators and adapters according to manufacturer's recommendations.

B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.

1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
4. Provide necessary mounting hardware and linkages for actuator installation.
5. Valve Actuators. Connect actuators to valves with adapters approved by actuator manufacturer

3.12 WARNING LABELS

A. Affix permanent warning labels to equipment that can be automatically started by the control system.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows.
   a. C A U T I O N: This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing

B. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.
      a. C A U T I O N: This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.13 IDENTIFICATION OF HARDWARE AND WIRING

A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.

B. Permanently label or code each point of field terminal strips to show instrument or item served.

C. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

D. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.

E. Label room sensors related to terminal boxes or valves with nameplates.

F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

G. Label identifiers shall match record documents.

3.14 PROGRAMMING

A. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.
   1. Application Programming. Provide application programming that adheres to the sequences of operation. Program documentation or comment statements shall reflect language used in sequences of operation.
   2. System Programming. Provide system programming necessary for system operation.

B. Operator Interface.
   1. Standard Graphics. Provide graphics as specified in Section 23 09 23 Article 2.3 Paragraph E.2 (System Graphics). Show on each equipment graphic input and output points and relevant calculated points. Point information on graphics shall dynamically update.
   2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation).

3.15 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.

1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 23.
2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
8. Alarms and Interlocks.
   a. Check each alarm with an appropriate signal at a value that will trip the alarm.
   b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
   c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.16 CLEANING

A. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.17 TRAINING

A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Training shall enable students to accomplish the following objectives.

1. Proficiently operate system
2. Understand control system architecture and configuration
3. Understand DDC system components
4. Understand system operation, including DDC system control and optimizing routines (algorithms)

5. Operate workstation and peripherals
6. Log on and off system
7. Access graphics, point reports, and logs
8. Adjust and change system setpoints, time schedules, and holiday schedules
9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
10. Understand system drawings and Operation and Maintenance manual
11. Understand job layout and location of control components
12. Access data from DDC controllers
13. Operate portable operator's terminals
14. Create and change system graphics
15. Create, delete, and modify alarms, including configuring alarm reactions
16. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
17. Configure and run reports
18. Add, remove, and modify system's physical points
19. Create, modify, and delete application programming
20. Add operator interface stations
21. Add a new controller to system
22. Download firmware and advanced applications programming to a controller
23. Configure and calibrate I/O points
24. Maintain software and prepare backups
25. Interface with job-specific, third-party operator software
26. Add new users and understand password security procedures

C. Divide presentation of objectives into three sessions (1-13, 14-23, and 24-26). Participants will attend one or more of sessions, depending on knowledge level required.
   1. Day-to-day Operators (objectives 1-13)
   2. Advanced Operators (objectives 1-13 and 14-23)
   3. System Managers and Administrators (objectives 1-13 and 24-26)

D. Provide course outline and materials according to Section 23 09 23 Article 1.10 (Submittals). Provide one copy of training material per student.

E. Instructors shall be factory-trained and experienced in presenting this material.

F. Perform classroom training using a network of working controllers representative of installed hardware.

END OF SECTION

SECTION 23 2113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Heating water and glycol piping, above grade.

D. Pipe and pipe fittings for:
   1. Equipment drains and overflows.

E. Pipe hangers and supports.

F. Unions, flanges, mechanical couplings, and dielectric connections.

G. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

H. Flow controls.

1.2 SUBMITTALS

A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.3 QUALITY ASSURANCE

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

B. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1.4 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.

1.5 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

2.2 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1 welded.
   2. Threaded Joints: ASME B16.3, malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
      b. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy.
   2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.4 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.

B. Conform to ASME B31.9.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

D. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

E. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

F. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

G. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

I. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

J. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

K. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

L. Vertical Support: Steel riser clamp.

M. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

N. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

O. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

P. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

Q. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

R. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.5 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Under:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 Inches:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick preformed neoprene.

C. Dielectric Connections: Union or waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.

2.6 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.apollovalves.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 2 Inches:
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches:
   1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.7 BUTTERFLY VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Hammond Valve: www.hammondvalve.com.
   3. Crane Co.: www.cranevalve.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM enscapsulation, or Buna-N enscapsulation.

D. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.

E. Disc: Aluminum bronze.

F. Operator: 10 position lever handle.

2.8 SWING CHECK VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Hammond Valve: www.hammondvalve.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C. Over 2 Inches:
   1. Iron body, bronze trim, stainless steel, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged or grooved ends.
   2. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.9 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Hammond Valve: www.hammondvalve.com.
   3. Crane Co.: www.cranevalve.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.10 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.

D. 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 psi.

PART 3 EXECUTION

3.1 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 using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements. Install chilled water piping to ASME B31.5 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls and floors.

G. Slope piping and arrange to drain at low points.

H. 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. Refer to Section 09 9000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.

J. Use eccentric reducers to maintain top of pipe level.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

L. Install valves with stems upright or horizontal, not inverted.

3.3 SCHEDULES

A. Hanger Spacing for Copper Tubing.
1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Steel Piping.
1. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
2. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
3. 8 inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.
4. 10 inches: Maximum span, 20 feet; minimum rod size, 3/4 inch.

END OF SECTION

SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Suction diffusers.

D. Combination pump discharge valves.

E. Pressure-temperature test plugs.

F. Balancing valves.

G. Combination flow controls.

H. Pump suction fittings.

I. Relief valves.

J. Pressure reducing valves.

1.2 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

1.3 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.

PART 2 PRODUCTS

2.1 AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.

2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.2 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. Green Country Filtration: greencountryfiltration.com.
3. WEAMCO: www.weamco.com.

B. Size 2 inch and Under:
1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
1. Flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. Size 5 inch and Larger:
1. Flanged iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.3 SUCTION DIFFUSERS

A. Manufacturers:
1. ITT Bell & Gossett: www.bellgossett.com.
2. Taco: www.tacohvac.com
3. Anvil International, Inc: www.anvilintl.com.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.4 COMBINATION PUMP DISCHARGE VALVES

A. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.5 PRESSURE-TEMPERATURE TEST PLUGS

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

B. Application: Use extended length plugs to clear insulated piping.

2.6 BALANCING VALVES

2.7 COMBINATION FLOW MEASURING AND BALANCING DEVICE

A. Manufacturers:
1. Flow Design
2. Preso

B. Venturi Style: bronze body, brass ball, and venturi flow measuring station.

C. Provide gauge kit for projects requiring over 20 balancing valves. Gauge kits shall be capable of directly reading GPM, or shall include conversion chart from Cv and pressure.

2.8 RELIEF VALVES

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Conbraco Industries: www.apollovalves.com.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.9 PRESSURE REDUCING VALVES

A. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 23 2113.

B. Materials of Construction:
1. Valve Body: Constructed of bronze, cast iron, brass, or iron.
2. Internal Components: Construct of stainless steel or brass and engineered plastics or composition material.

C. Connections:
   1. NPT threaded: 0.50 inch, or 0.75 inch.
   2. Soldered: 0.50 inch.

D. Provide integral check valve and strainer.

E. Maximum Inlet Pressure: 100 psi.

F. Maximum Fluid Temperature: 180 degrees F.

G. Operating Pressure Range: Between 10 psi and 25 psi.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blow down connection.

G. Support pump fittings with floor mounted pipe and flange supports.

H. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

I. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

J. Pipe relief valve outlet to nearest floor drain.

K. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

L. Clean and flush glycol system before adding glycol solution. Refer to Section 23 2500.

M. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

END OF SECTION

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Base mounted pumps.

1.2 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ITT Bell & Gossett: www.bellgossett.com.

2.2 HVAC PUMPS - GENERAL

A. Provide pumps that 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.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.3 **BASE MOUNTED PUMPS**

A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 125 psi maximum working pressure.

B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft.

D. Bearings: Oil lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 250 degrees F maximum continuous operating temperature.

H. Drive: Flexible coupling with coupling guard.

I. Baseplate: Cast iron or fabricated steel with integral drain rim.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Refer to Section 22 0548.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Lubricate pumps before start-up.

END OF SECTION

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.2 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers; Air-Conditioning, Heating, and Refrigeration Institute; 2009.

B. AHRI 760 - Standard for Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; Air-Conditioning, Heating, and Refrigeration Institute; 2007.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2013.

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2013.

E. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.

G. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.

D. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gage taps at compressor inlet and outlet.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
   1. Use line size strainer upstream of each automatic valve.

G. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

H. Solenoid Valves:
   1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.

1.4 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

PART 2 PRODUCTS

2.1 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
      a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   5. Vertical Support: Steel riser clamp.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.2 REFRIGERANT

2.3 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.4 VALVES

A. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

B. Packed Angle Valves:
   1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

D. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.5 STRAINERS

A. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.6 FILTER-DRIERS

A. Performance:
   1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
   2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   3. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

2.7 SOLENOID VALVES

A. Valve: AHRI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.1 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.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.4 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.

4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 23 2500 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical feeder equipment.

C. Chemical treatment.

1.2 SUBMITTALS

A. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

B. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AmSolv/Division of Amrep, Inc: www.amsolv.com.

B. GE Water Technologies: www.gewater.com.

C. Nalco Company: www.nalco.com.

2.2 MATERIALS

A. System Cleaner:
   1. Manufacturers:
      a. AmSolv/Division of Amrep, Inc: www.amsolv.com.
      b. GE Water Technologies: www.gewater.com.
      c. Nalco Company: www.nalco.com.
      d. H-O-H.
   2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.

B. Closed System Treatment (Water):
   1. Manufacturers:
      a. AmSolv/Division of Amrep, Inc: www.amsolv.com.

b. GE Water Technologies: www.gewater.com.
c. Nalco Company: www.nalco.com.

2. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
3. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
4. Conductivity enhancers; phosphates or phosphonates.

PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:
1. As recommended by manufacturer.

B. Hot Water Heating Systems:
1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.

3.3 CLOSED SYSTEM TREATMENT

A. Introduce closed system treatment through bypass feeder when required or indicated by test.

END OF SECTION

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

1.2 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

C. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

D. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.3 SUBMITTALS

A. Product Data: Provide data for duct materials, duct liner, duct connections, and factory fabricated fittings.

1.4 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

2.1 DUCT ASSEMBLIES

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. All Ducts: Galvanized steel, unless otherwise indicated.(Kitchen EA to be welded steel)

C. Low Pressure Supply (Heating Systems): 2 inch w.g. pressure class, galvanized steel.

D. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.

E. Return and Relief: 1 inch w.g. pressure class, galvanized steel.

F. General Exhaust: 1 inch w.g. pressure class, galvanized steel.

G. Kitchen Cooking Hood Exhaust: 1/2 inch w.g. pressure class, un-galvanized steel.
   1. Construct of 16 gage, 0.0598 inch sheet steel using continuous external welded joints in rectangular sections.

H. Outside Air Intake: 1 inch w.g. pressure class, galvanized steel.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. T's, bends, and elbows: Construct according to SMACNA (DCS).

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

F. 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.

G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

H. 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.

2.4 SPIRAL ROUND AND FLAT OVAL DUCT MANUFACTURERS

A. Metal-Fab, Inc.

B. Lindab: www.lindab.com

C. Semco, Inc.

D. United McGill Corporation.

2.5 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.

B. Flat Oval Ducts: Machine made from round spiral lockseam duct.
   1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards.
   2. Fittings: Manufacture at least two gages heavier metal than duct.
   3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

G. Use double nuts and lock washers on threaded rod supports.

H. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply (Heating and Cooling Systems): Steel, Aluminum
   2. Return and Relief: Steel, Aluminum.
   3. General Exhaust: Steel, Aluminum.

B. Ductwork Pressure Class:
   1. Supply (Heating and Cooling Systems): 2 inch
   2. Return and Relief: 1 inch.

3. General Exhaust: 1 inch.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Duct access doors.

D. Duct test holes.

E. Flexible duct connections.

F. Volume control dampers.

1.2 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS - METAL

2.3 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.

2.4 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.

2.5 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

2.6 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.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.8 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
   1. Blade: 24 gage, 0.0239 inch, minimum.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized 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

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. 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, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 x 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 3416 - CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Backward inclined centrifugal fans.

B. Motors and drives.

C. Fan accessories.

1.2 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).

B. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.

C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

E. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.3 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Fabrication: Conform to AMCA 99.

C. Performance Base: Sea level conditions.

D. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

1.4 SUBMITTALS

A. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

B. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Include complete installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Provide certified fan sound power ratings

1.6 FIELD CONDITIONS

A. Permanent fans may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Loren Cook Company: www.lorencook.com.

B. Greenheck.

2.2 WHEEL AND INLET

A. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

2.3 HOUSING

A. Heavy gage steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut

B. Factory finish before assembly to manufacturer's standard. For fans handling air downstream of humidifiers, provide two additional coats of paint. Prime coating on aluminum parts is not required.

C. Provide bolted construction with horizontal flanged split housing, where indicated.

2.4 BEARINGS AND DRIVES

A. Bearings: Heavy duty pillow block type, selfgreasing ball bearings, with ABMA 9 life at 50,000 hours.

B. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.

C. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at

mid Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

D. Belt Guard: Fabricate to SMACNA Duct Construction Standards; 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.5 ACCESSORIES

A. Inlet/Outlet Screens: Galvanized steel welded grid.

B. Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.

C. Scroll Drain: 1/2 inch steel pipe coupling welded to low point of fan scroll.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible connections between fan inlet and discharge ductwork; refer to Section 23 3300. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide fixed sheaves required for final air balance.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers.

1.2 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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hart & Cooley, Inc: www.hartandcooley.com.

B. Krueger: www.krueger-hvac.com.

C. Price Industries: www.price-hvac.com.

D. Titus: www.titus-hvac.com.

2.2 LOUVERS

2.3 INTAKE AND RELIEF LOUVERS

A. 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 performace and water penetration ratings.

B. Fabrication:
   1. Frame:
      a. Material: Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.081 inch (2.1mm), nominal.
      c. Depth: 4 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: 4 inches.

3. Bird Screen:
   a. Material: Aluminum, 3/4 inch x 0.51 inch expaned, 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.

C. Perforamce Data:
1. Design Load: Incorporate structural supports required to withstand wind load of 25 pounds per square foot (100 mph wind equivalent).

D. Accessories:
1. Blank-Off Panels: 0.063 inch extruded aluminum, 2 inch insulated core, finish to match louver.
2. Insect Screen: Aluminum mech construction.

E. Factory Finish:
1. Baked Enamel Finish:
   a. Color shall be as selected by architect.
   b. Finish to be applied after a thourough cleaning and preparation of the metal surface.
   c. Total dry film thickness: 1.2 mils.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9000.

END OF SECTION

SECTION 23 7313 - MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Factory fabricated assembly of modular sections consisting of housed centrifugal or plenum fans with belt or direct drives, coils, filters, and other necessary modules to perform one or more of the functions of circulating, cleaning, heating, cooling, humidification, dehumidification, and mixing of air with construction suitable for indoor or outdoor applications.

1.2 RELATED REQUIREMENTS

A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 22 0719 - Plumbing Piping Insulation.

C. Section 23 0719 - HVAC Piping Insulation.

D. Section 23 3300 - Air Duct Accessories: Flexible duct connections.

E. Section 23 3416 - Centrifugal HVAC Fans.

1.3 SUBMITTALS

A. Product Data:
   1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
   2. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

1.4 QUALITY ASSURANCE

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

B. Units shall be manufactured in a facility registered to ISO 9001:2000 manufacturing quality standard.

C. Air handling unit assembly shall have UL 1995 certification for safety, including use with electric heat.

D. Products requiring electric connection shall be listed and classified by ETL and CSA as suitable for the purpose specified and indicated.

E. Coil performance shall be certified in accordance with ARI standard 410.

F. Air handling unit shall be ARI 430 listed and meet with NFPA 90A requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.6 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply one set for each unit of fan belts.

1.7 START-UP REQUIREMENTS

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly trapped, piping connections verified and leak tested, belts aligned, and tensioned, all shipping braces have been removed, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 SEE SECTION 01 6000 FOR ADDITIONAL REQUIREMENTS.

2.2 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Daikin Applied: www.daikinapplied.com.

C. Trane Inc: www.trane.com.

2.3 GENERAL DESCRIPTION

A. Components:
   1. Casing construction.
   2. Fan section.
   3. Filter and air cleaner section.
   4. Damper section.
   5. Controls.

B. Unit shall be factory-supplied, central station air handler. The air handling unit may consist of a fan with the following factory-installed components as indicated on the equipment schedule:

1. Mixing Box Section:
   a. With angle filter tracks.
   b. No filter tracks.
2. Air Mixer Section.
3. Exhaust Box Section.
4. Integral Face and Bypass Section:
   a. With hot water coil.
   b. With steam coil.
5. Integral Face and Bypass Damper Section.
6. External Face and Bypass Damper Section.

C. Fabrication: Conform to AMCA 99 and AHRI 430.
   1. Plenum Section:
      a. With drain pan.
      b. No drain pan.
   2. External Bypass Return Section.
   3. Humidifier Section.
   4. Blow-Thru Discharge Plenum Section:
      a. No coil.
      b. With cooling coil.
      c. With heating coil.
   5. Filter Section:
      a. 2 in. flat filters.
      b. 4 in. flat filters.
      c. 2 in. angle filters.
      d. 4 in. angle filters.
      e. Side loading 12 in. bag/cartridge filters with -in. pre-filters.
      f. Side loading 30 in. bag/cartridge filters with -in. pre-filters.
      g. Face loading bag/cartridge filters without re-filters. Maximum bag/cartridge filter length is limited to access/plenum sections laced after this section.
      h. Face loading HEPA (high efficiency articulate air) bag/cartridge filters without re-filters.
   6. Coil Section:
      a. Chilled water coil.
      b. Direct expansion coil.
      c. Hot water coil.
      d. Steam coil.
      e. Electric coil.
   7. Multi-Zone Cooling/Heating Coil Section:
      a. With dampers.
      b. No dampers (for dual duct).
   8. Fan Section:
      a. Horizontal draw-thru.
      b. Horizontal blow-thru (with integral diffuser).
      c. Plenum fan.
      d. Vertical draw-thru.

2.4 CASING CONSTRUCTION

A. Full Perimeter Base Rail:
   1. Construct of galvanized steel.
   2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:
   1. Construct of one piece, insulated, double wall panels.
   2. Provide mid-span, no through metal, internal thermal break.
   3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
   4. Casing Air Pressure Performance Requirements:

C. Access Doors:
   1. Construction, thermal and air pressure performance same as casing.
   2. Provide surface mounted handles on hinged, swing doors.

D. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

E. Casing Leakage: Seal all joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

F. Insulation:
   1. Provide minimum thermal thickness of 12 R throughout.
   2. Completely fill all panel cavities in all directions preventing voids and settling.
   3. Comply with NFPA 90A.

G. Construction:
   1. Unit shall be constructed of a complete frame with easily removable panels. Removal of any panel shall not affect the structural integrity of the unit. Single height coil sections shall have removable frame sections to facilitate vertical coil extraction.
   2. All units shall be supplied with 16-gage, G-90 galvanized steel base rails. Perimeter 10-gage lifting lugs for overhead lifting shall be provided on each section.
   3. Outdoor units shall be supplied with a perimeter, 10-gage, G-90 galvanized, high tensile steel base rail with a pocket to accomodate roof curb. The base rail shall be factory-installed. Perimeter lifting lugs for overhead lifting shall be provided.
   4. Unit shall be thermally broken to minimize the conduction path from the inside of the casing to the outside.
   5. Casing panels (top,sides, and bottom) shall be constructed of galvanized steel, and shall have one of the following exterior finishes as specified:
      a. Pre-painted with a baken enamel finish passing 500 hour salt spray test (ASTM B-117) for pre-painted steel and 125 hour marine level 1 prohesion test (ASTM G-85.A5) for pre-painted steel.
      b. Unpainted G-90 galvanized steel.
   6. Outdoor units roofs shall be double-wall, pitched in four directions at a minimum roof slope of 1/4 inch per foot across the width of the unit. No penetrations shall be made in pressure

sensitive panels. Roof shall incorporate a standing top seam. All seams in the roof shall be gasketed and capped to prevent water infiltration into the unit.

7. Casing panels (top,sides, and bottom) shall be constructed of galvanized steel, and shall have one of the following interior finishes as specified:
   a. Pre-coated with a silver zeolite antimicrobial material registered by the US EPA for use in HVAC applications.
   b. Unpainted G-90 galvanized steel.
8. Casing panels (top, sides, and bottom) shall have no exterior exposed raw edges that could lead to rust formation. All casing corners shall be radiused or chamfered.
9. Casing panels (top, sides, and bottom) shall be one piece, double-wall construction with insulation sealed between the inner and otuer panels. Panel assemblies shall not carry an R-value of less than 13.
10. Casing deflection shall not exceed a 1:200 ratio when subject to an internal pressure of +/- 5 inch wg.
11. Side panels shall be easily removable for access to unit and shall seal against a full perimeter automotive style gasket to ensure a tight seal.
12. The panel retention system shall comply with UL 1995 which states all moving parts that could cause bodily injury shall be guarded against accidental contract by an enclosure requiring tools for removal.
13. Outdoor units shall have a base rail that overhangs the curb to facilitate water run-off and to protect the curb to base connection from water intrusion.
14. Accessibility options shall be as follows:
   a. Hinged double-wall access door on either side with removable access panels on the other side.
   b. Hinged double-wall access doors on both sides.
   c. Removable double-wall access panels on both sides.
15. Fan supports, structural members, panels, or flooring shall not be welded, unless aluminum, stainless steel, or other corrosion-resistant material is used. Painted welds on unit exterior steel or galvanized steel are not acceptable.
16. All coil sections shall be double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13. Single height coil sections shall have removable frame sections to facilitate vertical coil extraction.
17. Blow-thru sections shall have a diffuser plate as an integral part of the fan section.

H. Insulation:

1. Each section shall be factory insulated. Casing panels shall be solid doublewall construction of pre-painted galvanized steel inner and outer panels and insulation. The resultant minimum R value of the panel assemblies shall not carry an R value of less than 13.

I. Access Doors:

1. Access doors shall be one piece, double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.

J. Drain Pans:

1. Drain pans shall be insulated double-wall galvanized or stainless steel construction. The pan shall be sloped in 4 directions toward the drain fitting. Drain pan shall have a recessed bottom drain design with 1-1/2 in. MPT connection. Drain connection shall be insulated from the drain pan to the point at which it exits the casing. One drain outlet shall be

supplied for each cooling coil section. Drain pan shall allow no standing water and comply with ASHRAE Standard 62.

K. Finish:

2.5 FAN SECTION

A. Type: Forward curved, single width, single inlet, centrifugal plug type fan. Refer to Section 23 3416.

B. General:

1. Forward curved fans shall have one double-width double-inlet (DWDI) fan wheel and scroll. They shall be constructed of galvanized steel with baked enamel. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I or II). Completed fan assmebly shall be dynamically balanced in accordance with 1989 ARI Guideline G and ANSI S2.19-1986 at design operating speed using contract drive and motor if ordered.
2. Airfoil fan sections shall have one DWDI airfoil fan wheel and scroll. Airfoil blades shall be double thickness design constructed of heavy gage, high strength steel or aluminum continuously welded to the backplate and the spun inlet flange. Entire fan assembly shall be cleaned, primed and painted with alkyd enamel, except for an aluminum fan wheel when supplied. Fans shall have AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I, II, or III). Completed fan assembly shall be dynamically balanced to minimum grade of G 6.3 per ANSI/AMCA 204-96 at design operating speed using contract drive and motor if ordered.
3. Plenum fan sections shall have one single-width single-inlet (SWSI) airfoil fan wheel. Airfoil blades shall be double thickness design constructed of heavy gage, high strength steel or aluminum continuously welded to the backplate and the spun inlet flange. Entire fan assembly shall be cleaned, primed and painted with alkyd enamel, except for an aluminum fan wheel when supplied. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I, II, or III). Completed fan assembly shall be dynamically balanced to minimum grade of G6.3 per ANSI/AMCA 204-96 at design operating speed using contract drive and motor if ordered.
4. Fan shafts shall be solid steel, turned, ground, polished and coated with a rust inhibitor.
5. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected with a maximum operating sped 25% below the first critical.
6. Fan motor shall be mounted within the fan section casing on the slide rails equipped with adjusting screws. Motor shall be high efficiency, open dripproof or totally enclosed fan cooled NEMA Design B with size and electrical characteristics as shown on the equipment schedule. All three-phase motors shall have a +/- 10% voltage utilization range and a 1.15 minimum service factor. Motor shall be compliant with EPACT where applicable. Single phase motors shall be available up to and including 5 hp.

C. Performance Ratings: Fan performance shall be rated and certified in accordance with ARI Standard 430.

D. Sound Ratings: Manufacturer shall submit first through eighth octave sound power for fan discharge and casing radiated sound.

E. Mounting: Fan, scroll, wheel, shaft, bearings, drives, and motor shall be mounted on a common base assembly. The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal.

F. Fan Accessories:
   1. Forward-curved fans:
      a. Variable frequency drives with or without bypass.
      b. Magnetic motor starters.
      c. Motor disconnects.
      d. Belt guards.
      e. Inlet screen.
   2. Airfoil fans:
      a. Variable frequency drives with or without bypass.
      b. Magnetic motor starters.
      c. Motor disconnects.
      d. Belt guards.
      e. Inlet screen.
   3. Plenum fans:
      a. Variable frequency drives with or without bypass.
      b. Magnetic motor starters.
      c. Motor disconnects.
      d. Inlet screen and wheel cage.
   4. Flexible Connection: The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable.
      a. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.
      b. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

G. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

H. Flexible Duct Connections: For separating fan and coil, and adjacent sections; refer to Section 23 3300.

I. Bearings: Self-aligning, grease lubricated, anti-friction with lubrication fittings extended to drive side of fan section.
   1. Heavy duty pillow block type, self-aligning, regreasable ball or roller type bearings selected for a minimum average life (L50) of 200,000 hours, or optionally for 500,000 hours.

J. Shafts: Fan shafts shall be solid steel, turned, ground, polished and coated with a rust inhibitor.

K. V-Belt Drive: Drive shall be designed for a minimum 1.2 service factor as standard with 1.5 service factor option and/or factory supplied extra set of belts. Drives shall be fixed pitch with optional variable pitch for motors 15 hp or less. All drives shall be factory mounted, with sheaves aligned and belts properly tensioned.

2.6 COIL SECTION

A. All water, steam and direct expansion (DX) refrigerant coils shall be provided to meet the schedule performance. All coil performance shall be certified in accordance with ARI Standard 410. All water and DX coils shall be tested at 450 psig air pressure. Direct expansion coils shall be designed and tested in accordance with ASHRAE/ANSI 15 Safety Code for Mechanical Refrigeration (latest edition).

B. General Fabrication:
   1. All water and refrigerant coils shall have a minimum 1/2 inch OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.016 inches.
   2. Aluminum plate fin type with belled collars.
   3. Aluminum finned coils shall be supplied with dieformed casing and tube sheets of mill galvanized steel or stainless steel as specified. Copper finned coils shall be supplied with stainless steel casing and tube sheets.

C. Hydronic Heating and Cooling Coils:
   1. Headers shall be constructed of steel with steel MPT connections. Headers shall have drain and vent connections accessible from the exterior of the unit. Optional non-ferrous headers and nipples shall be supplied.
   2. Configuration: Coils shall be drainable, with non-trapping circuits. Coils will be suitable for a design working pressure of 300 psig at 200 F.

D. Refrigerant Coils:
   1. Headers shall be constructed of copper with brazed joints.
   2. Replacable nozzle, brass refrigerant distributors and seamless copper distribution tubes are supplied to ensure uniform flow.

2.7 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

2.8 DAMPER SECTION

A. Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor, return, and exhaust air.

2.9 CONTROLS

A. Factory Installed Direct Digital Control (DDC) System:(Coordinate with TC contractor to provide a complete, operable system per plans)
   1. Factory engineer and test all components.
   2. Provide fully functional control system to operate in either stand-alone mode or as part of the building automation system (BAS) via single pair of twisted wires tie-in.
   3. DDC Controller:
      a. Dedicated, field programmable DDC controller with appropriate point capabilities.

4. Control Options:
   a. Electronic End Devices:
      1) Accommodate integration into existing building systems.
      2) Wire to standard point locations of unit mounted DDC controller or terminal block for remote controller.
   b. Mixing Section Spring Return Damper Actuators:
      1) Outdoor Air Damper: Normally closed.
      2) Return Air Damper: Normally open.
   c. Air Flow Measurement Stations: 2 to 10 VDC signal corresponding to CFM for controlling and documenting airflow.
   d. Fan Discharge Temperature and Temperature Averaging Sensors: Suitable for integration into the BAS system.
   e. Low Limit Switches:
      1) Factory wire to momentary push-button reset circuit.
      2) Provide separate low limit for each coil in a coil stack.
   f. Airflow Switches: Pipe to both filter sides to indicate fan status.
   g. Dirty Filter Switches: Pipe to both filter sides to indicate filter status.

B. Factory Provided Controls for Field Installation:
   1. Control Valves.
   2. Space and Outdoor Air Temperature Sensors.

2.10 FILTER SECTIONS

A. Flat filter sections shall accept either 2 inch or 4 inch filters. Sections shall include side access slide rails.

B. Angle filter sections shall accept either 2 inch or 4 inch filters of standard sizes, arranged in a horizontal, V formation.

C. Draw thru bag/cartridge filter sections shall be capable of accepting headered standard size 6 inch to 12 inch deep rigid media or bag filters.

D. Blow thru bag/cartridge filter sections shall contain a face loading filter frame and be capable of accepting standard size 12 inch deep rigid media or bag filters.

E. Blow thru HEPA filter sections shall contain a face loading filter frame and be capable of accepting standard size 12 inch deep HEPA box filters.

F. Magnahelic Gages:
   1. Housing shall be constructed of a die cast aluminum case and bezel with acrylic cover. Exterior finish shall be coated gray to withstand 168 hr salt spray corrosion test.
   2. Accuracy shall be +/-2% of full scale throughout range at 70 F.
   3. Pressure limits shall be -20 inch Hg to 15 psig.
   4. Overpressure relief plugs shall open at approximately 25 psig.
   5. Temperature limits shall be 20 to 140 F.
   6. Diameter of dial face shall be 4 in.
   7. Process connections shall be 1/8 in. female NPT duplicate high and low pressure taps - one pair side and one pair back.

G. Mixing boxes, filter-mixing boxes, and exhaust boxes shall have parallel or opposed blades and interconnecting outside air and return air dampers.

1. Standard dampers: Damper blades shall be constructed of galvanized steel, with blade seals and stainless steel jamb seals. Blades shall be mechanically fastened. Maximum leakage rate shall be 4 cfm/sq. ft. at 1 in. WG differential pressure.
2. Options: Premium dampers: Damper blades shall be constructed of galvanized steel, with blade seals and stainless steel jamb seals. Blades shall be mechanically fastened. Maximum leakage rate shall be 2 cfm/sq. ft. at 1 in. WG differential pressure.
3. Outside Air Measurement Dampers:
   a. Damper frame shall be constructed of 6063-T5 extruded aluminum.
   b. Airflow measuring blades shall be airfoil-shaped, heavy gage anodized 6063-T5 extruded aluminum.
   c. Jamb seals shall be flexible metal compression type along control damper sides.
   d. Blade seals shall be neoprene along control damper blade edges.
   e. Bearings shall be molde synthetic.
   f. Linkage shall be galvanized steel, concealed in frame.
   g. Axles shall be minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade.
   h. Operating temperature shall be -22 to 140 F.
   i. Air straightener section shall be aluminum alloy honeycomb contained in 5 inch. long, 16 gage steel sleeve attached to monitoring blade frame.
   j. Airflow range shall be 400 to 5000 FPM face velocity.
   k. Maximum leakage rate shall be 2 cfm/sq. ft at 1 in. WG differential pressure.
4. Integral Face and Bypass
   a. Integral face and bypass (IFB) coils shall be capable of maintaining a constant air volume, within 5%, shall be capable of maintaining a constant leaving air temperature as entering air conditions vary, and shall be capable of producing mixed leaving air temperatures within 3 ft downstream with a maximum variance in air temperature of 5 deg. F, regardless of damper position.
   b. When no heating is required, dampers shall divert air to bypass around heating surface with minimal temperature override.
   c. Coil casing, dampers and baffles shall be fabricated from galvanized steel with an option for stainless steel. Coilds shall be tested at 300 psig.
   d. IFB coils shall be provided with a connection point for field mounted actuator (s), electrical or pneumatic.
   e. Actuator connection point shall be mechanically attached to the dampers via linkage mechanisms. Dampers shall be interconnected for operation simultaneously across each face of coil.
5. Internal Face and Bypass Dampers:
   a. Internal face and bypass dampers shall be factory mounted in galvanized steel frame. Damper blades shall be constructed of galvanized steel with high temperature blade and edge seals. Face damper blades shall be opposed and arranged to match coil face with top bypass and internal linkage.
   b. External face and bypass dampers shall be factory mounted in galvanized steel frame. Damper blades shall be constructed of galvanized steel with high temperature blade and edge seals. Face damper blades shall be opposed and arranged to match coil face with top bypass and internal linkage.
6. Multi-Zone Dampers:
   a. Multi-zone dampers shall be factory mounted in galvanized steel frame. Damper blades shall be constructed of galvanized steel with a double-skin airfoil design, with blade seals and stainless steel jamb seals. Maximum leakage rate shall be 11 cfm/sq.

ft. at 1 in. WG differential pressure. Maximum pressure drop due to dampers shall be no more than 0.40 in. WG.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

D. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Refer to Section 22 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Provide fixed sheaves required for final air balance.

F. Make connections to coils with unions or flanges.

G. Hydronic Coils:
   1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
   2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
   3. Locate water supply at bottom of supply header and return water connection at top.
   4. Provide manual air vents at high points complete with stop valve.
   5. Ensure water coils are drainable and provide drain connection at low points.

H. Refrigerant Coils: Provide sight glass in liquid line within 12 inches of coil.

I. Insulate coil headers located outside air flow as specified for piping. Refer to Section 23 0719.

J. Field-wire all factory provided controls for field installation.

END OF SECTION

SECTION 23 8101 - TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Unit heaters.

B. Unit ventilators.

1.2 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
   3. Indicate mechanical and electrical service locations and requirements.,

C. Manufacturer's Instructions: Indicate installation instructions and recommendations.

D. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.3 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for unit ventilator motors.

PART 2 PRODUCTS

2.1 UNIT HEATERS

A. Manufacturers:
   1. Sterling Hydronics/Mestek Technology, Inc: www.sterlingheat.com.

B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Casing: 0.0478 inch steel with threaded pipe connections for hanger rods.

D. Finish: Factory applied baked primer coat.

E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

F. Air Outlet: Adjustable pattern diffuser on projection models and two way louvers on horizontal throw models.

G. Motor: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models. Refer to Section 23 0513.

H. Control: Local multi-speed disconnect switch.

2.2 UNIT VENTILATORS - REFER TO MECHANICAL EQUIPMENT SCHEDULES ON PLANS

A. Manufacturers:

1. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

D. Unit Ventilators: Locate as indicated, level and shim units, and anchor to structure. Coordinate exact location of wall louvers. Install shelving and auxiliary cabinetry. Provide wall trim pieces for continuous wall-to-wall installation.

E. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Section 26 2717.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Install new filters.

END OF SECTION

SECTION 23 8127 - SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air cooled condensing units.

B. Indoor ductless fan & coil units.

C. Controls.

1.2 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.3 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.1 MANUFACTURERS - REFER TO PLANS

A. Substitutions: See Section 01 6000 - Product Requirements.

2.2 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

C. Electrical Characteristics:

1. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 26 2717.

2.3 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.

1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
2. Manufacturer: System manufacturer.

C. Remote Actuators:

2.4 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.

1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).

1. Provide thermostatic expansion valves.

C. Operating Controls:

1. Control by room thermostat to maintain room temperature setting.
2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

D. Mounting Pad: Pressure preservative treated wood timbers, minimum 4 inches square; minimum of two located under cabinet feet.

2.5 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from setpoint.
3. Short cycle protection.
4. Thermostat display:
   a. Actual room temperature.
   b. Programmed temperature.

c. Programmed time.
d. System mode indication: heating, cooling, fan auto, off, and on, auto or on, off.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION

SECTION 26 0500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 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.

1.2 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.

1.3 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.

1.4 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.

1.5 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.

1.6 ALTERNATES

A. See Alternate Section and other applicable parts of the specifications.

1.7 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.

1.8 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.

1.9 STANDARDS OF MATERIAL AND WORKMANSHIP:

A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
   1. A.N.S.I.American National Standards Institute
   2. A.S.T.M.American Society for Testing Materials
   3. I.C.E.A.Insulated Cable Engineers Association
   4. I.E.E.E.Institute of Electrical and Electronics Engineers
   5. N.E.C.National Electrical Code
   6. N.E.M.A.National Electrical Manufacturer's Association
   7. U.L.Underwriters Laboratories, Inc.

B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.

C. All equipment of the same or similar systems shall be by the same manufacturer.

1.10 RECORD DRAWINGS

A. Provide complete operating and maintenance instruction manuals covering all electrical equipment herein specified, together with parts lists. All literature shall be furnished in triplicate for Owner and shall be bound in book or ring binder form as directed by Architect/ Engineer.

B. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:

C. Routine maintenance procedures.

D. Trouble-shooting procedures.

E. Shop Drawings

F. Any equipment offered as a substitution shall be equal in quality, durability, appearance, ampacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system. All costs to make these items of equipment comply with these requirements including, but not limited to, conduit, wiring, bus work, enclosures and building alterations shall be included in the original bid. Similar equipment shall be by one manufacturer.

1.11 SHOP DRAWINGS/SUBMITTALS

A. All shop drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.

B. Submit for approval eight (8) copies of shop drawings for all electrical systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the drawings and specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical specifications for additional requirements.
   1. Panelboards
   2. Motor Control
   3. Disconnect Switches
   4. Time Switches
   5. Wiring Devices
   6. Lighting Fixtures
   7. Fire Alarm System
   8. Sound Systems

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

2.1 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.

2.2 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.

2.3 CHASES AND RECESSES

A. Provided by the architectural trades, but the contractor shall be responsible for their accurate location and size.

2.4 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.

2.5 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.

2.6 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.

2.7 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.

2.8 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.

2.9 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

1.1 SECTION INCLUDES

A. Electrical demolition.

1.2 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 unforseen significant non code compliance conditions of the existing installation they shall notify the Architect and Engineer immediately in writting.

E. During demolition the contractor shall record on the as-builts all demolished circuits numbers that can be used for new circuiting.

1.3

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner before disturbing existing installation.

E. Report discrepancies to Strategic Energy Solutions, Inc. before disturbing existing installation.

F. Beginning of demolition means installer accepts existing conditions.

3.2 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.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

3.3 **DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. 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.

D. 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

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Nonmetallic-sheathed cable.

C. Underground feeder and branch-circuit cable.

D. Service entrance cable.

E. Metal-clad cable.

F. Wiring connectors.

G. Electrical tape.

H. Oxide inhibiting compound.

I. Wire pulling lubricant.

1.2 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.

F. Section 31 2316 - Excavation.

G. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.3 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.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2009).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2011).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007 (Reapproved 2012).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

I. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; National Electrical Contractors Association; 2012 (NECA/AA 104).

J. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); National Electrical Contractors Association; 2006.

K. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); National Electrical Contractors Association; 2007.

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).

M. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

N. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

P. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

Q. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

R. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

S. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

T. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

U. UL 719 - Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.

V. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 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.

1.5 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.

1.6 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 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

2.1 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.
   1. Exceptions:
      a. Use manufactured wiring systems for branch circuits where concealed under raised floors.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.

C. Underground feeder and branch-circuit cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. For damp, wet, or corrosive locations as a substitute for NFPA 70, Type NMC nonmetallic-sheathed cable, when nonmetallic-sheathed cable is permitted.

D. Armored cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

E. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:

1. Provide copper conductors 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.
   a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
      1) Services: Copper conductors size 1/0 AWG and larger.
      2) Feeders: Copper conductors size 1/0 AWG and larger.
   b. Where aluminum conductors are substituted for copper, comply with the following:
      1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
      2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.
4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

H. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. 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. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com.
      b. Encore Wire Corporation: www.encorewire.com.
      c. Southwire Company: www.southwire.com.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
      c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.4 NONMETALLIC-SHEATHED CABLE

A. Manufacturers:
   1. Cerro Wire LLC: www.cerrowire.com.
   2. Encore Wire Corporation: www.encorewire.com.
   3. Southwire Company: www.southwire.com.

B. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

2.5 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Manufacturers:
   1. Cerro Wire LLC: www.cerrowire.com.
   2. Encore Wire Corporation: www.encorewire.com.

3. Southwire Company: www.southwire.com.

B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

C. Provide equipment grounding conductor unless otherwise indicated.

D. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

2.6 SERVICE ENTRANCE CABLE

A. Manufacturers:
   1. Copper Service Entrance Cable:
      a. Encore Wire Corporation: www.encorewire.com.
      b. Southwire Company: www.southwire.com.
      c. _____.

B. Conductor Stranding: Stranded.

C. Insulation Voltage Rating: 600 V.

2.7 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com.
   2. Encore Wire Corporation: www.encorewire.com.
   3. Southwire Company: www.southwire.com.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.
   1. Provide additional isolated/insulated grounding conductor where indicated or required.

G. Armor: Steel, interlocked tape.

2.8 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

D. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.9 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.

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M: www.3m.com.
      b. American Polywater Corporation: www.polywater.com.
      c. Ideal Industries, Inc: www.idealindustries.com.

PART 3 EXECUTION

3.1 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.

3.2 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.

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. Install aluminum conductors in accordance with NECA 104.

E. Install nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.

F. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

G. Install metal-clad cable (Type MC) in accordance with NECA 120.

H. 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.

I. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

J. 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.

K. 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.

L. Install conductors with a minimum of 12 inches of slack at each outlet.

M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

N. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

O. 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. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

P. 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.

Q. Insulate ends of spare conductors using vinyl insulating electrical tape.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

S. 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.

3.3 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 4000.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. 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.

D. 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

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground rod electrodes.

1.2 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.

C. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association; 2007.

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. 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 ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Strategic Energy Solutions, Inc.. Precipitation within the previous 48 hours does not constitute normally dry conditions.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.

G. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
3. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
4. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
5. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
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 0519:

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.
4. Manufacturers - Mechanical and Compression Connectors:
   a. Advanced Lightning Technology (ALT): www.altfab.com.
   b. Burndy: www.burndy.com.
   c. Thomas & Betts Corporation: www.tnb.com.

D. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Manufacturers:
   a. Advanced Lightning Technology (ALT): www.altfab.com.
   b. Erico International Corporation: www.erico.com.
   c. Galvan Industries, Inc: www.galvanelectrical.com.

PART 3 EXECUTION

3.1 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.

3.2 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. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. 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.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Perform inspection in accordance with Section 01 4000.

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

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0534 - Conduit: Additional support and attachment requirements for conduits.

C. Section 26 0537 - Boxes: Additional support and attachment requirements for boxes.

D. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

E. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

F. Construction requirements for concrete bases

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association; 2004.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; 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.

1.4 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.

1.5 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.

1.6 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.

1.7 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.8 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

2.1 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 by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
      b. Erico International Corporation: www.erico.com.

c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
d. Thomas & Betts Corporation: www.tnb.com.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
b. Erico International Corporation: www.erico.com.
c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
d. Thomas & Betts Corporation: www.tnb.com.
e. _____.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
3. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
b. Thomas & Betts Corporation: www.tnb.com.
c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
d. Substitutions: See Section 01 6000 - Product Requirements.
e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch diameter.
b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
b. Erico International Corporation: www.erico.com.
c. PHP Systems/Design: www.phpsd.com.
d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2. 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. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Wood: Use wood screws.
8. Plastic and lead anchors are not permitted.
9. 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.
10. 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

3.1 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. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.2 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

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Flexible metal conduit (FMC).

E. Liquidtight flexible metal conduit (LFMC).

F. Electrical metallic tubing (EMT).

G. Rigid polyvinyl chloride (PVC) conduit.

H. Conduit fittings.

I. Conduit, fittings and conduit bodies.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems.

E. Section 26 0537 - Boxes.

F. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.3 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 C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2013.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2013.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

N. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

P. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.4 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.

1.5 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.

1.6 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.

1.7 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

2.1 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. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
   2. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
   3. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   4. 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 Hollow Stud Walls: Use electrical metallic tubing (EMT).

E. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

F. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

G. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit 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 or intermediate metal conduit (IMC).

J. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

2.2 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

C. 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.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 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.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

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 IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

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.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Thomas & Betts Corporation: www.tnb.com.
2. Robroy Industries: www.robroy.com.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.6 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.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

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. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.8 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com.
   2. Beck Manufacturing, Inc: www.beckmfg.com.
   3. Wheatland Tube Company: www.wheatland.com.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.

D. Description: ANSI C80.3; galvanized tubing.

E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com.
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
   3. JM Eagle: www.jmeagle.com.

B. 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.

C. 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.

PART 3 EXECUTION

3.1 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.

3.2 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 intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.

H. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. 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.
4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
5. Use conduit clamp to support single conduit from beam clamp or threaded rod.
6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
7. Use of spring steel conduit clips for support of conduits is not permitted.
8. Use of wire for support of conduits is not permitted.

I. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

J. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

K. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 2316.13 - Trenching.
2. Minimum Cover, Unless Otherwise Indicated or Required:
a. Underground, Exterior: 36 inches.
b. Under Slab on Grade: 12 inches to bottom of slab.

L. 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.

M. 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.

N. Provide grounding and bonding in accordance with Section 26 0526.

3.3 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. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 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 0537 - BOXES

PART 1 GENERAL

1.1 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.

1.2 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 2726 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

F. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 2).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specification for Underground Enclosure Integrity; Society of Cable Telecommunications Engineers; 2013 (ANSI/SCTE 77).

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.

1.4 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.

1.5 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.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 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 by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
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. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: Comply with Section 27 1005.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
13. Wall Plates: Comply with Section 26 2726.
14. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Hubbell Incorporated; RACO Products: www.hubbell-raco.com.
    c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    d. Thomas & Betts Corporation: www.tnb.com.

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

3.1 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.

3.2 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. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. 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 as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
      b. Communications Systems Outlets: Comply with Section 27 1005.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   9. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

I. 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.

J. Install boxes plumb and level.

K. 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.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 26 0526.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 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

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Warning signs and labels.

G. Field-painted identification of conduit.

1.2 RELATED REQUIREMENTS

A. Section 09 9000 - Painting and Coating.

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.

C. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

D. Section 27 1005 - Structured Cabling for Voice and Data: Identification for communications cabling and devices.

1.3 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; National Fire Protection Association; 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.

1.4 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.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.6 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

B. Conform with ANSI A13.1 and ANSI C2.

C. Conform with 29 CFR 1910.145.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
      b. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
   3. Emergency System Equipment:
      a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
      b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
   4. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

5. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

C. 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.

D. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Color Code:
      2) Field-Painting: Comply with Section 09 9000.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.

E. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 09 9000 per the same color code used for raceways.

F. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 27 1005.
2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
3. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:
   a. Brimar Industries, Inc: www.brimar.com.
   b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
   c. Seton Identification Products: www.seton.com.
2. Materials:
3. 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. Manufacturers:
   a. Brady Corporation: www.bradyid.com.
   b. Brother International Corporation: www.brother-usa.com.
   c. Panduit Corp: www.panduit.com.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.

D. Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.

3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

I. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

J. 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 _____.

2.3 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.

2.4 VOLTAGE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com.
   2. Brimar Industries, Inc: www.brimar.com.
   3. Seton Identification Products: www.seton.com.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
   1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com.
   2. Brimar Industries, Inc: www.brimar.com.
   3. Seton Identification Products: www.seton.com.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
   1. Tape for Buried Power Lines: Black text on red background.

2.6 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. 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

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.2 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. Branch Devices: Adjacent to device.

6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

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.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0933 - CENTRAL DIMMING CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Central dimming control systems.

B. Related Sections:
   1. Section [265113 – Interior Lighting Fixtures, Lamps, and Ballasts:]

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
   1. C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. International Electrotechnical Commission .
   1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
   2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

C. International Organization for Standardization (ISO)
   1. 9001:2000 – Quality Management Systems.

D. National Electrical Manufacturers Association (NEMA)
   1. WD1 (R2005) - General Color Requirements for Wiring Devices.

E. Underwriters Laboratories, Inc. (UL) :
   1. 508 (1999) - Standard for Industrial Control Equipment.
   2. 1472 (1996) - Solid-State Dimming Controls.

1.3 SYSTEM DESCRIPTION

A. Central dimming control system
   1. Factory assembled dimming and switching panels.
   2. Low voltage [wall stations] [and] [control interfaces]

1.4 SUBMITTALS

A. Submit under provisions of Section [013300.]

B. Specification Conformance Document: Indicate whether the submitted equipment:
   1. Meets specification exactly as stated.
   2. Meets specification via an alternate means and indicate the specific methodology used.

C. Shop Drawings; include:
   1. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
   2. Schematic of system.

D. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.

B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

C. Central dimming control system:
   1. Listed by [UL] specifically for the required loads. Provide evidence of compliance upon request.

1.6 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
   2. Relative humidity: Maximum 90 percent, non-condensing.
   3. Lighting control system must be protected from dust during installation.

1.7 WARRANTY

A. Provide Manufacturer's Warranty:
   1. Standard 2-year warranty, Includes:
      a. 100 Percent Replacement Parts for Manufacturer Lighting System Components
      b. 100 Percent Manufacturer Labor Coverage to Troubleshoot and Diagnose a Lighting Issue
      c. First–Available Onsite or Remote Response Time
      d. 24 Hours Per Day, 7 Days Per Week Telephone Technical Support, Excluding Manufacturer Holidays
      e. Remote Diagnostics for Applicable Systems

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Lutron Electronics Co., Inc. – System: Lutron GRAFIK Eye 4000

B. [Basis of design product: Lutron GRAFIK Eye 4000 or subject to compliance and prior approval with specified requirements of this section, one of the following:]

1. Lutron GRAFIK Eye 4000
2. <Insert manufacturer's name>

C. Substitutions [Under provisions of Division 1.]
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders.
   2. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
   3. Any substitutions provided by the contractor shall be reviewed at the contractor's expense by the electrical engineer at a rate of [$200.00] per hour.
   4. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.
   5. Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

2.2 GENERAL

A. Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.

C. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

2.3 DIMMING / RELAY PERFORMANCE REQUIREMENTS

A. Electrolytic capacitors to operate at least 20 degrees C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40 degrees C (104 degrees F) ambient temperature.

B. Load Handling Thyristors (SCRs and triacs), Field Effect Transistors (FETs), and Isolated Gate Bipolar Transistors (IGBTs): Manufacturer's maximum current rating minimum two times control's rated operating current.

C. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer/relay.

D. Design and test dimmers/relays to withstand line-side surges without impairment to performance.
   1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41 and per IEC 61000-4-5 surge requirements.
   2. Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.

E. Utilize air gap off, activated when user selects “off” at any control to disconnect the load from line supply.

F. Power failure memory and dimmer/relay recovery:
   1. When power is interrupted and subsequently returned, within 3 seconds lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption.

G. Dimmers:
   1. Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage/cycle), frequency shifts (plus or minus 2 Hz change in frequency/second), dynamic harmonics, and line noise.
   2. Systems not providing cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.
   3. Each dimmer to incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.
   4. Control all light sources in smooth and continuous manor. Dimmers with visible steps are not acceptable.
   5. Each dimmer to be assigned a load type that will provide a proper dimming curve for the specific light source.
   6. Possess ability to have load types assigned per circuit, configured in field.
   7. Minimum and maximum light levels user adjustable on circuit-by-circuit basis.
   8. Line Voltage Dimmers; Meet following load-specific requirements:
      a. Magnetic Low Voltage (MLV) transformer:
         1) Contain circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472, Section 5.11.
         2) Dimmers using unipolar load current devices (such as FETs or SCRs) to include DC current protection in the event of a single device failure.
      b. Electronic Low Voltage (ELV) transformer:
         1) Dimmer to operate electronic low voltage transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformers being provided.
         2) Magnetic transformers: UL listed for use with normal (low) power factor magnetic transformers.
         3) Electronic transformers: Must be supported by the ballast equipment manufacturer for control of specific ballasts being provided.
   9. Low Voltage Dimming Modules; Meet following requirements:
      a. Coordination between low voltage dimming module and line voltage relay: Capable of being electronically linked to single zone.

H. Non-dim circuits to meet the following requirements:
   1. Rated life of relay at full load: Minimum 1,000,000 cycles.
   2. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
   3. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

2.4 POWER PANELS

A. Product: Lutron LP series.

B. Mechanical:
   1. Listed to UL 508 as industrial control equipment.
   2. Delivered and installed as a [UL] listed factory assembled panel.
   3. Field wiring accessible from front of panel without need to remove dimmer assemblies or other components.
   4. Panels passively cooled via free-convection, unaided by fans or other means.
   5. Ship panels with each dimmer in mechanical bypass position by means of jumper bar inserted between input and load terminals. Jumpers to carry full rated load current and be reusable at any time. Mechanical bypass device to allow for switching operation of connected load with dimmer removed by means of circuit breaker.

C. Electrical:
   1. Panels contain branch circuit protection for each input circuit unless the panel is a dedicated feed-through type panel or otherwise indicated on the drawings.
   2. Branch circuit breakers; meet following performance requirements:
      a. Listed to UL 489 as molded case circuit breaker for use on lighting circuits.
      b. Contain visual trip indicator; rated at [10,000 AIC, 120 V Dimming], [14,000 AIC, 277 V Dimming], [18,000 AIC, 277 V Switching].
      c. Thermal-magnetic construction for overload, short-circuit, and over-temperature protection. Use of breakers without thermal protection requires dimmers/relays to have integral thermal protection to prevent failures when overloaded or ambient temperature is above rating of panel.
      d. Accept tag-out/lock-out devices to secure circuit breakers in off position when servicing loads.
      e. Replaceable without moving or replacing dimmer/relay assemblies or other components in panel.
      f. UL listed as switch duty (SWD) so that loads can be switched on and off by breakers.
   3. Minimum UL listed Short Circuit Current Rating (SCCR) of [25,000A] [45,000A] [65,000A].

D. Lutron LP Series [Light Duty Commercial Lighting Control Panel]
   1. [Flush into wall] [Surface mounted]
   2. Utilize multiple load type 16A feed continuous-use UL listed dimming/switching modules.
   3. For switching only circuits, utilize 1,000,000 cycle relay.
   4. [Utilize multiple load type low voltage dimming module.]

E. Preset Lighting Control with Zone Override; [Lutron Grafik Eye GRX-4500]:
   1. Intensity for each zone indicated by means of one illuminated bar graph per zone.
   2. Fade time indicated by digital display for current scene while fading.
   3. Incorporate built-in wide angle infrared receiver.
   4. For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.

2.5 SOURCE QUALITY CONTROL

A. Perform full-function testing on 100 percent of all system components and panel assemblies at the factory.

B. Sample burn-in at 40 degrees C (104 degrees F) ambient temperature of dimming assemblies and panels at full load for 2 hours.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Provide complete installation of system in accordance with Contract Documents.

C. Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.

D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

E. Mount exterior daylight sensors to point due north with constant view of daylight.

F. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

G. [Systems Integration:
   1. Equipment Integration Meeting Visit (LSC-INT-VISIT)
      a. Facility Representative to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures.]

3.2 SERVICE AND SUPPORT

A. Startup and Programming
   1. [Provide telephone startup assistance to Electrical Contractor or End User Representative (when available, in accordance with manufacturer's guidelines. Otherwise, onsite startup will be utilized.)
      a. Provides access to a Factory Certified Telephone Startup Technician during normal business hours.
      b. Provides telephone instruction and guidance for a complete system functional test.
      c. With phone startup completion and End User Registration, the 1-year parts-only warranty will be upgraded to the Standard 2-year Warranty.]

B. Tech Support
   1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

3.3 FIELD QUALITY CONTROL

3.4 CLOSEOUT ACTIVITIES

A. [Training Visit (LSC-TRAINING)
   1. Lighting Control System Manufacturer to provide [1] [__] day additional on-site system training to site personnel.]

3.5 MAINTENANCE

A. Capable of providing on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 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.

E. Section 26 4300 - Surge Protective Devices.

1.3 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; National Electrical Contractors Association; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.

F. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.

G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2013 (ANSI/NEMA PB 1.1).

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

I. NFPA 70 - National Electrical Code; National Fire Protection Association; 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.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 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.

1.6 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.

1.7 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens Industry, Inc: www.usa.siemens.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. General Electric Company: www.geindustrial.com.

D. Schneider Electric; Square D Products: www.schneider-electric.us.

2.2 ALL PANELBOARDS

A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

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:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
   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.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

2.3 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: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 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: Copper, suitable for terminating copper conductors only.
   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: Copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 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:
         1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Provide compression lugs where indicated.
      c. 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.
      a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
      b. Provide interchangeable trip units where indicated.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

6. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

2.6 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

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 panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

I. Provide grounding and bonding in accordance with Section 26 0526.

J. Install all field-installed branch devices, components, and accessories.

K. Provide filler plates to cover unused spaces in panelboards.

L. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.

3.3 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 4000.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. Tests listed as optional are not required.

D. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.2 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.

1.3 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; National Electrical Contractors Association; 2010.

D. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2010).

E. NEMA WD 6 - Wiring Device -- Dimensional Specifications; National Electrical Manufacturers Association; 2002 (R2008).

F. NFPA 70 - National Electrical Code; National Fire Protection Association; 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.

1.4 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.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.

C. Operation and Maintenance Data:
   1. Wall Dimmers: Include information on operation and setting of presets.
   2. GFI Receptacles: Include information on status indicators and testing procedures and intervals.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.6 **QUALITY ASSURANCE**

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to authorities having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 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

2.2 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 GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

D. Provide GFI protection for all receptacles installed within 6 feet of sinks.

E. Provide GFI protection for all receptacles installed in kitchens.

F. Provide GFI protection for all receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

H. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.3 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.4 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc: www.leviton.com.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: Ivory plastic with toggle handle.
   2. Ratings:
      a. Voltage: 120 - 277 volts, AC.
      b. Current: 20 amperes.

2.5 WALL DIMMERS

A. Manufacturers:

1. Leviton Manufacturing Company, Inc: www.leviton.com.
2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. All Wall Dimmers: 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.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

2.6 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, , listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFI Receptacles:
1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.7 WALL PLATES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. All Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 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 GFI receptacles with integral GFI 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.

P. Identify wiring devices in accordance with Section 26 0553.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Strategic Energy Solutions, Inc..

3.6 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 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 2416 - Panelboards: Fusible switches.

C. Section 26 2818 - Enclosed Switches: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment 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.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com.

B. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.

C. Littelfuse, Inc: www.littelfuse.com.

2.2 APPLICATIONS

A. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

C. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

D. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 FUSES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

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.

G. Class R Fuses: Comply with UL 248-12.

H. Class CC Fuses: Comply with UL 248-4.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2818 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 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.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 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.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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.

1.6 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.

1.7 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.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens Industry, Inc: www.usa.siemens.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

2.2 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 and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

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. Provide with switch blade contact position that is visible when the cover is open.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

J. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

K. Heavy Duty Switches:
   1. Products:
   2. Comply with NEMA KS 1.
   3. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 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 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Fluorescent emergency power supply units.

F. Lamps.

G. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

D. Section 26 5600 - Exterior Lighting.

1.3 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. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

E. IES LM-80 - Approved Method: Measuring Lumen Maintenance of LED Light Sources; Illuminating Engineering Society; 2008.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.

J. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 101 - Life Safety Code; National Fire Protection Association; 2012.

L. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 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.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   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.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Ballast product specification sheet from manufacturer.

1.6 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.

1.7 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.

1.8 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 full 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.

1.9 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Furnish ten replacement lamps for each lamp type.

C. Furnish two of each ballast type for each school.

D. Furnish two of each emergency battery type for each school.

PART 2 PRODUCTS

3.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

3.2 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 and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

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.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

3.3 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.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Accessories:
1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Provide compatible accessory wire guards where indicated.
4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

3.4 EXIT SIGNS

A. All Exit Signs: Internally illuminated 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.

B. Self-Powered Exit Signs:
1. 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.
2. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
3. Provide low-voltage disconnect to prevent battery damage from deep discharge.
4. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

3.5 **BALLASTS AND DRIVERS**

A. All Ballasts:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
   a. Wall Dimmers: See Section 26 2726.

3.6 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

A. Manufacturers:
   1. Iota Engineering, LLC: www.iotaengineering.com.
   2. Lithonia Lighting: www.lithonia.com.
   3. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Compatibility:
   1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.

D. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

E. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

3.7 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.

3.8 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

4.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

4.2 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.

4.3 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. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. 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.

L. 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.

M. Fluorescent Emergency Power Supply Units:
1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.

N. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

O. Install lamps in each luminaire.

P. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

4.4 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..

4.5 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.

4.6 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.

4.7 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Just prior to Substantial Completion, replace all lamps that have failed.

4.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

4.9 ATTACHMENTS

A. Luminaire schedule.

END OF SECTION

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0537 - Boxes.

D. Section 26 2813 - Fuses.

E. Section 26 5100 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 5th Edition, with 2011 Interim Revisions

B. IEEE C2 - National Electrical Safety Code; 2012.

C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

D. IES LM-80 - Approved Method: Measuring Lumen Maintenance of LED Light Sources; Illuminating Engineering Society; 2008.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

F. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1598 - Luminaires; Current Edition, Including All Revisions.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Strategic Energy Solutions, Inc. of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.

D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

H. Exposed Hardware: Stainless steel.

2.3 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Comply with AASHTO LTS.
      b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
      c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
   3. Material: Steel, unless otherwise indicated.
   4. Shape: Square straight, unless otherwise indicated.

5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
7. Unless otherwise indicated, provide with the following features/accessories:
   a. Top cap.
   b. Anchor bolts with leveling nuts or leveling shims.
   c. Provision for pole-mounted weatherproof GFI receptacle where indicated.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

F. Pole-Mounted Luminaires:
1. Maintain the following minimum clearances:
   a. Comply with IEEE C2.
   b. Comply with utility company requirements.
2. Foundation-Mounted Poles:
   a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
      1) Install anchor bolts plumb per template furnished by pole manufacturer.
      2) Position conduits to enter pole shaft.

b. Install foundations plumb.
c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
d. Tighten anchor bolt nuts to manufacturer's recommended torque.

3. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install lamps in each luminaire.

3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Strategic Energy Solutions, Inc..

3.4 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Strategic Energy Solutions, Inc.. Secure locking fittings in place.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.6 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.7 ATTACHMENTS

A. Luminaire schedule.

END OF SECTION

SECTION 26 5701 - OCCUPANCY SENSORS AND INDOOR PHOTOCELLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall Switch Sensors - Small Areas

B. Wall Switch Sensors - Large Areas

C. Low Voltage Occupancy Sensors

D. Ultrasonic Occupancy Sensors

E. Dual Technology Occupancy Sensors

F. Power Packs

G. Indoor Photocells and Daylight Harvesting Controls

1.2 RELATED SECTIONS

A. Section 26 5100 Interior Luminaires

B. Section 26 5600 Exterior Luminaires

1.3 ALTERNATIVES

A. See Section 01 2300 - Alternatives, for product alternatives affecting this section.

1.4 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

1.5 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.

1.6 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.

1.7 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.

1.8 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.

1.9 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.

1.10 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

2.1 MANUFACTURERS

A. Sensor Switch, Inc.

B. The Wattstopper

C. Leviton

D. Lutron

2.2 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.

2.3 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.

K. HID controller shall be compatible with all types of High Intensity Discharge (HID) lamps, including Metal Halide, Metal Halide Pulse Start, and High Pressure Sodium.

L. HID controller shall operate with HID lamps utilizing Constant Wattage Autotransformer (CWA) type ballasts.

M. To avoid lamp damage during the HID power up period, the HID controller shall maintain a full light level during lamp warm up for 15 minutes.

N. To maximize lighting control scenarios, the HID controller shall be compatible with any 24 VDC controlling device, such as occupancy sensors, time switches, control panels, or photocells.

2.4 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.

2.5 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.

2.6 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.

2.7 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 ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

2.8 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.

2.9 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 INDOOR PHOTOCELLS AND DAYLIGHT HARVESTING CONTROLS

A. Low voltage photocell shall accept 12 to 24 VAC or VDC and provide a SPDT relay for interface with remote switching system. Sensor shall interface with occupancy sensors, directly with power pack, or other system as shown.

B. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

C. Photocell set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an “Automatic Set-point Programming” procedure. Further adjustment may be made manually if needed.

D. Low voltage dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).

E. Low voltage dimming sensor's set point shall be automatically calibrated through the sensor's microprocessor by initiating the “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.

F. Low voltage dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the “auto set-point” setting.)

G. Combination photocell/dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control the on/off function as well as the dimming function of 0 to 10 VDC dimmable ballasts.

H. Combination photocell/dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating the “Automatic Set-point Programming” procedure. Min and max dim settings as well as set point may be manually entered.

I. Combination photocell/dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the “auto set-point” setting.)

J. Dual zone option shall be available for photocell, dimming, or combination units. The second zone shall be controlled as an “offset” from the primary zone and shall be the zone farthest from the natural light source.

K. Line voltage versions of the above described photocell and combination photocell/dimming 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.

L. Line voltage versions of the above described dimming sensors shall be capable of powering off 120/277 VAC.

M. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching 5 Amps of two phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.

PART 3 EXECUTION

3.1 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.

3.2 FACTORY COMMISSIONING (OPTIONAL)

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system. This service is provided at an additional cost.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors.

3.3 INTERFACE WITH OTHER WORK

A. Verify that installed sensors are coordinated with all lighting controls and luminaires to provide a complete lighting control system.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. 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.

3.5 ADJUSTING

A. Adjust _____ for smooth operation.

3.6 CLEANING

A. Clean _____.

B. Protect installed _____ from subsequent construction operations.

C. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 27 4000 - SOUND SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Attention is directed to General Conditions, Supplementary Conditions and General Requirements, which are hereby made a part of this Section.

1.2 DESCRIPTION:

A. A. Provide basic materials and methods for electrical work and install in accordance with the Contract Documents.

B. Major items of work and equipment included under this Section of the Specifications are provisions applicable to Sound System.

C. References to other Sections of the Specifications: Basic Electrical Materials and Methods - Section 26 00 00.

1.3 GENERAL CONDITIONS:

A. Provide all labor and materials required for the complete installation of the sound systems as hereinafter specified and as shown on the drawings.

B. Individual parts and complete assemblies shall be in all particulars as specified and as manufactured by DBX, Crown, JBL, and Lowell and as distributed by I.COMM of Farmington Hills, MI. Substitution of equipment and/or services beyond the alternatives listed herein must be submitted for written approval by the Electrical Contractor ten (10) days prior to the bid date. Upon receipt of approval, such substitute equipment and/or services may be submitted as an additive or deductive alternate. Material and/or services as specified shall constitute the base bid.

C. The Sound Contractor shall be an authorized distributor of the specified equipment and shall upon request, supply manufacturers verification attesting to this fact.

D. Sound equipment shall be new and where applicable, shall bear manufacturers model and serial numbers.

E. The Electrical Contractor shall furnish and install the conduit, wire and other items of “rough-in” equipment and shall properly tag the sound cables at the termination points.

F. The Sound Contractor shall furnish and install to the Electrical Contractor’s tagged circuits the sound equipment an shall test, equalize, adjust and place the system into operation and shall include in his proposal one eight (8) hour man day to instruct the Owner’s representative in the recommended operation of the systems.

G. All equipment and workmanship shall be guaranteed for a period of one (1) year from date of acceptance against defects.

H. The Contractor must maintain a sufficient service organization and be able to respond to a call for service within 24 hours.

1.4 SHOP DRAWINGS AND SUBMITTALS:

A. The Sound Contractor shall submit for approval the required number of brochures containing typewritten, accurate material lists, supporting catalog data on major items of equipment together with functional block diagrams and equipment rack layouts for each system prior to assembly or installation.

B. At the conclusion of the project, the Sound Contractor shall submit three prints of “as built” functional block diagrams, rack layouts, operation manuals for all control equipment. Additionally, each equipment cabinet shall contain “as wired” functional block diagrams showing all components and their connection by number. All internal cabinet wiring shall be tagged in accordance with the functional diagrams.

1.5 FUNCTIONAL REQUIREMENTS:

A. The Gymnasium system shall provide for the pickup, amplification and distribution of local microphones both wired and wireless and local program sources.

1.6 EQUIPMENT:

1.7 EQUIPMENT RACKS

A. Location: Gym
   1. New (on platform)
   2. Types:
      a. Gym
      b. Provide floor mounted, free standing with rack mounted Lowell LER-3522 with front locking door. Provide Middle Atlantic PD-915R ac strip for components. Include 2 space storage drawer.

1.8 SOURCE COMPONENTS:

A. CD/MP3 deck combination (quantity 1)
   1. Location: Gym
   2. Acceptable Products: Tascam CD-200 iL
   3. Ipod interface with lightening or 32 pin connection
   4. 2 rack space

B. Amplifiers:
   1. 120-Watt Power Amplifier (quantity 1)
      a. Location: Gym
      b. Power amplifier shall be solid-state, dual channel model employing switching power supply.
      c. Direct constant voltage (70v) or low impedance (2/4/8 ohm) operation.
      d. Front panel status indicators for power, data and bridge, ready, signal clip, thermal and fault for each channel.
      e. 120-watt 70v, 8 ohm and 4 ohm. 240 watt 8 ohm both channels driven.
      f. Total harmonic distortion (THD) at full rated power from 20 Hz to 20 kHz: <0.1%.
      g. Acceptable Product: Crown CSA120.

h. 2 rack space configuration

1.9 MIXERS

A. 8 input rack mount mixer (quantity 1)
1. Location: Gym
2. Acceptable Products: Crown 28M.
3. 1 rack space configuration
4. 8 mic or line inputs switchable

B. Gym Multi Channel Digital Processor
1. 2x2 DSP (Digital Signal Processor).
2. Advanced AFS (Advanced Feedback Suppression)
3. Computer programmable
4. It shall provide mixers; equalizers; filters (HPF,LPF,high shelf,low shelf, all-pass)
5. Crossovers; 2-way, 3-way and 4-way
6. Dynamics; leveler, comp/limiter
7. Matrix mixer
8. Delay 1.3 seconds
9. Controls; levels; preset, logic; RS232, etc.
10. Meters; Signal present, peak, RMS
11. Graphic, parametric EQ
12. Acceptable Product: DBX 220i.

C. Loudspeakers
1. Gym (quantity per drawings)
a. Locations: See drawings
b. The loudspeaker shall consist of a 200-mm
1) (8-inch) low-frequency transducer in a
2) trapezoidal-shaped enclosure; a high-frequency
3) compression driver with a pure titanium
4) 25mm diaphragm coupled to a 90° x 90°
5) constant-directivity horn molded into the
6) front baffle of the enclosure; and a passive
7) crossover-equalizer network with protection.
c. Acceptable Products: Gym; JBLControl 28T-W with MTC 28/25CM (No substitution)
d. The unit shall provide 70.7 volt taps of 15, 30 and 60 watts.

D. Receptacles
1. Flush Wall Mounted or Stage Face Microphone Receptacles (quantity per drawings)
a. Location: As shown on drawings
b. Stainless steel plate with XLR female jack.
c. Acceptable Products: Switchcraft J3FS or Proco WP1004.

E. Volume Attenuators (quantity per drawings)
1. Location: As shown on drawings

2. Stainless steel faceplate with engraved paint filled indications.
3. Rotary knob adjustments from 0-10.
4. 10 watt type
5. Acceptable Product: Atlas Sound AT10B or Lowell 10LC2

F. Wireless Microphones

G. Gym system (quantity 2)
1. Location: Gym
2. True Diversity type with rack mounted receiver and antennas
3. Both handheld and head worn systems (1-handheld; 1-belt pack)
4. UHF with 12 channel capabilities per band.
5. Acceptable Products: AKG WMS 470 series

H. Microphones and Accessories
1. Handheld stage microphones/stand mounted (quantity 2)
a. Cardioid condenser
b. AKG C5
c. Provide each with Atlas Sound MS12CE floor stand and 25ft extension cord A3F to A3M.

1.10 BUILDING LOCAL PA SPEAKERS

1.11 THE BUILDING LOCAL PA SPEAKERS IN THE GYM AND OUTDOOR SHALL BE CONNECTED TO THE MAIN

A. PA system and shall be run as a single home-run circuit and shall be zoned separately. The speakers shall be a Quam System 1, surface mounted to the trusses. Outdoor speakers shall be weather proof rated and shall be by Quam.

1.12 CABLING

A. Low impedance loudspeaker cabling shall be West Penn #25227 2 conductor 12 ga. jacketed. 70 volt loudspeaker cable shall be West Penn #25225 2 conductor 16 ga.

B. Microphone/building PA cabling shall be West Penn #25292 2 conductor 20 ga. with overall shield and drain wire.

1.13 FINAL TESTING AND ADJUSTMENTS:

A. The Sound Contractor shall make all system adjustments. The Sound Contractor shall test the system for parasitic oscillations using an oscilloscope. He shall measure the impedance of each speaker line and test for shorts. He shall apply a 1kHz test tone and test all speakers for buzzes and mechanical rattles and to ensure each loudspeaker is working properly.

B. The Sound Contractor shall equalize the system utilizing a 1/3 octave real time analyzer. The system shall be equalized for best overall response and maximum gain before feedback using the wireless and house microphones.

C. The Sound Contractor shall document all final filter settings with one (1) copy permanently affixed inside the rear door of each rack and one (1) copy to be turned over to the Owner in case of accidental misadjustment the Owner can return all filter settings to their original settings.

1.14 LABELING

A. All controls, input receptacles shall be permanently labeled using engraved plastic. Stick on or dry transfer type labeling will not be accepted.

1.15 1.10 LOUDSPEAKER RIGGING

A. Loudspeaker loads to be dead hung from the building structure or permanently attached using Uni-Strut channel and hardware.

B. Loudspeaker to be hung using manufacturer's recommended hardware.

C. A structural engineer licensed in the State of Michigan shall approve rigging and attachments.

D. Loudspeakers, if hung, shall utilize wire rope with a minimum diameter of 0.125 and shall utilize thimbles at each end.

E. Loudspeakers shall not hang below the bottom of the ceiling trusses.

1.16 TRAINING

A. Sound Contractor shall furnish a minimum of four (4) hours of in-service training to staff and maintenance personal. Session shall be scheduled with the owner through the General Contractor with at least 7 days advanced notice. Operation and maintenance manuals shall be available during these sessions. Manuals shall be turned over to the General Contractor after the session for record purposes.

END OF SECTION

SECTION 28 3100 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm control panels (FACP).

B. Remote annunciator panels.

C. Alarm initiating devices.

D. Fire alarm signaling appliances.

E. Auxiliary devices.

F. Conduit and wire.

1.2 RELATED SECTIONS

A. Section 013000 - Administrative Requirements.

B. Section 016000 - Product Requirements.

C. Section 017000 - Execution Requirements.

D. Section 081000 - Doors and Frames.

E. Section 087100 - Door Hardware.

F. Section 211300 - Fire Suppression Sprinklers.

G. Section 233300 - Ductwork Accessories; Smoke Dampers.

H. Section 260519 - Low-Voltage Electrical Power Conductors and Cables

1.3 REFERENCES

A. UL 864 9th Edition.

B. NFPA 70 - National Electrical Code.

C. NFPA 72 - National Fire Alarm Code.

D. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.

1.4 SYSTEM DESCRIPTION

A. Fire Alarm System: NFPA 72A; automatic addressable fire alarm system.

1. Fire Alarm System: Micro-processor based control system suitable for use as a local fire alarm system with integrated emergency communications using automatic and manual initiating devices.
   a. LCD display to indicate all information associated with the Fire Alarm condition, including type of alarm and location within the protected premise.
   b. Non-volatile history buffer to log time and date of each occurrence, large enough to log all potential alarms without losing any alarm initiations.
   c. All control functions activated within three seconds after receipt of alarm condition.
   d. All components UL Listed for the intended application.

B. System Supervision: Provide electrically supervised system, with supervised alarm initiating and alarm signaling circuits. Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. A single ground or open condition on alarm initiating or signaling circuit does not disable that circuit from transmitting in ALARM.

C. Alarm Sequence of Operation: Actuation of manual fire alarm station or automatic initiating device causes system to enter ALARM, which includes the following operations:
   1. Sound and display local fire alarm signaling devices with non-coded signal.
   2. Indicate location of alarm condition on fire alarm control panel, on fire fighter control panels, and on remote annunciator panel.
   3. Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation.
   4. Transmit signal to release door hold-open devices.
   5. Record in non-volatile memory the event, time and date, and the device initiating the alarm condition.

D. Alarm Reset: Key accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.

E. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:
   1. Visual and audible trouble alarm by zone at control panel.
   2. Visual and audible trouble alarm at annunciator panel.
   3. Manual ACKNOWLEDGE function at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.

F. Drill Sequence of Operation: Manual DRILL function causes ALARM mode operation to:
   1. Sound and display local fire alarm signaling devices.
   2. Indicate location of alarm zone on fire alarm control panel, fire fighters control panel, and on remote annunciator panel.

G. The fire alarm system shall comply with UL 864 9th edition.

1.5 SYSTEM FUNCTION

A. The system shall be a complete, electrically supervised fire detection and evacuation system with microprocessor based operating system having the following capabilities, features and capacities.

B. Communication shall be capable of the networking of thirty-two connected intelligent local control panels.
   1. Each network connected local control panel shall have the capacity to supervise and annunciate up to the maximum number of devices as listed for the signaling line circuit (SLC) classification and style number as defined by NFPA 72.
   2. Analog addressable detection circuits shall be class B, style 4 wiring with a minimum of 126 addresses.
   3. Sensitivity settings of individual detectors shall be adjustable using a drift compensation algorithm from the local control panel to reduce incidence of false alarms caused by environmental conditions.
   4. The system shall support analog smoke detection, manual station, water flow switches, tamper switches and status monitoring devices. The local control panel shall be UL listed as a test instrument for the measurement and logging of the sensitivity of connected intelligent devices.
   5. Any intelligent analog smoke detector shall include alarm verification capability.
   6. The system shall have the capability of logging to historical memory, the time and date of all events or unverified alarm conditions in order to track activity and generate maintenance reports.

C. All external circuits shall be listed as power limited circuits per article 760 of the National Electric Code.

D. Each circuit interface panel shall be capable of operating in its own degrade mode. In this mode, the system shall receive an alarm from any intelligent analog or conventional initiating device. It shall activate local indicating appliances and remote or auxiliary connected circuits.

E. The system shall have the capability of being tested by one person at the control panel.

F. The local control panel shall provide status indicators for the following functions as applicable.
   1. Audible and visual evacuation alarm circuit zone control.
   2. Status indicators for sprinkling system waterflow and valve supervisory devices.
   3. Status indicators for generator running, generator fault, generator switch in non-automatic position, and generator low fuel.

G. The system and associated batteries shall have the capacity to add 20% additional alarm devices.

1.6 SUBMITTALS

A. Submit shop drawings and product data sheets under provisions of Section 260500.

B. References to manufacturer's model numbers and other pertinent information herein establishing minimum standards of performance, function, and quality.
   1. Equivalent equipment from other manufacturers that meet minimum standards may be substituted for the specified equipment.
   2. For equipment other than specified, submit proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

C. Product Data Sheets: Material and equipment information including manufacturer's catalog data sheets and pertinent technical data for each component or device used on the system, including the following:
   1. Control panel.
   2. Analog smoke sensors.
   3. Manual discharge stations.
   4. Abort stations.
   5. Contact monitoring devices.
   6. Releasing Devices.
   7. Addressable relays.
   8. Addressable supervised output modules.
   9. Graphic annunciators.

D. Shop Drawings:
   1. Sufficient information, clearly presented, to determine compliance with drawings and specifications.
   2. Include manufacturer's name, model numbers, ratings, power requirements, equipment layout, device arrangement, complete point-to-point wiring diagrams, and conduit layout.

E. Manufacturer's Installation Instructions:
   1. Submit simultaneously with shop drawings
   2. Indicate application conditions and limitations of use stipulated by product testing agency.

F. Submit complete shop drawings to the State Fire Marshal for review and approval. Include all fees in original bid.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under the provisions of Section 017000.

B. Submit four copies of record drawings showing the locations of fire alarm devices and appliances, the locations of end-of-line resistors and junction boxes, the addresses of addressable devices, the tap settings of audible notification appliances, the intensity ratings of visual notification appliances, the sizes of conduits and conductors, circuit numbers, and deviations from the design.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under the provisions of Section 017000.

B. Provide operating instructions and maintenance procedures.

C. After installation, include manufacturer representative's letter stating that the system is operational.

1.9 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Company specializing in manufacturing the products specified in this section for at least ten years.
   2. Name of manufacturer, part number, and serial number shall appear on all major components.
   3. All devices, components, and equipment shall be the products of a single manufacturer.
   4. All devices, components, and equipment shall be new and standard products of the manufacturer's latest design, suitable to perform the functions intended.

B. Installer's Qualifications:
   1. Firm regularly engaged in installation of systems similar to those specified in this section with five years minimum experience in design, installation, testing, and service of fire detection and control systems.
   2. Trained and certified by the manufacturer to design, install, test, and service the fire detection and control system provided under this section.
   3. Employ a NICET certified fire alarm system designer, level 2 or above, who will be responsible for this project.
   4. Show evidence of a minimum two million dollar liability and completed operations insurance policy. These limits supersede limits required elsewhere in this specification.
   5. Provide proof of emergency service available 24 hours a day, seven days a week.

C. Regulatory Requirements:
   1. System shall conform to the requirements of NFPA 70, NFPA 72, and NFPA 101.
   2. Furnish products listed and classified by Underwriters Laboratories Inc. and/or Factory Mutual Research Corporation as suitable for the purpose specified and indicated.
   3. System shall conform to the requirements acceptable to the authority having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers:
   1. National Time and Signal Corporation
      a. Model: A901-FACP Series

B. Provide all fire alarm systems from a single manufacturer.

C. General Description:
   1. Modular, power-limited design with electronic modules, UL 864 listed.
   2. Addressable initiation devices shall communicate device identity and status.
   3. Addressable control circuits for operation of mechanical equipment.

D. Alphanumeric Display and System Controls: Arranged for interface between the operator at the FACP and addressable system including annunciation, paging and supervision of the system

components. Displaying alarm, supervisory, trouble, monitor, status message, and providing a programming and control menu:

1. Annunciator and Display: Liquid-crystal type, two lines by 40 characters, minimum.
2. Keypad: Arranged to permit access and entry to a menu driven display for display and control of device enable/disable, device on/off control, one-man walk test, sensitivity reporting, history, and panel configuration.

E. FACP User Interface: System events shall be stored in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have automatic priority viewing over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression. On the activation of a system event the following sequence shall occur:
   1. On Alarm: The FACP interface shall display the first alarm event with the ability to scroll to the subsequent alarm events via the Alarm Queue button. The FACP interface shall on alarm display the following:
      a. The Alarm Queue Led flashes indicating an alarm status is present.
      b. A custom message is displayed detailing location.
      c. The display shall indicate the number of active alarms present on the system.
      d. The Alarm event status shall be identified as an active or restored event.
      e. Alarm event acknowledge sequence shall execute as follows:
         1) The Alarm Queue button will sequentially step the operator through the alarm events, acknowledging the event on each Alarm Queue button depression. On the completion of acknowledging all alarm events, the Alarm Queue Led illuminates steady.
         2) A secondary means to view the alarm events shall be available via the up and down arrows. The Alarm Queue button shall return the display to the last acknowledged event.
         3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
   2. On Supervisory: The FACP interface shall display the first supervisory event with the ability to scroll to the subsequent supervisory events via the Supervisory Queue button. The FACP interface shall on supervisory display the following:
      a. The Supervisory Queue Led flashes indicating a Supervisory status is present.
      b. A custom message is displayed detailing location.
      c. The display shall indicate the number of active Supervisory(s) present on the system.
      d. The Supervisory event status shall be identified as active or restored.
      e. Supervisory event acknowledge sequence shall execute as follows:
         1) The Supervisory Queue button will sequentially step the operator through the supervisory events, acknowledging the event on each Supervisory Queue button depression. On the completion of acknowledging all supervisory events, the Supervisory Queue Led illuminates steady.
         2) A secondary means to view the supervisory events shall be available via the up and down arrows. The Supervisory Queue button shall return the display to the last acknowledged event.
         3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
   3. On Trouble: The FACP interface shall display the first Trouble event with the ability to scroll to the subsequent Trouble events via the Trouble Queue button. The FACP interface shall on Trouble display the following:
      a. The Trouble Queue Led flashes indicating a Trouble status is present.
      b. A custom message is displayed detailing location.

c. The display shall indicate the number of active Troubles present on the system.
d. The Trouble event status shall be identified as active or restored event.
e. Trouble event acknowledge sequence shall execute as follows:
1) The Trouble Queue button will sequentially step the operator through the trouble events, acknowledging the event on each Trouble Queue button depression. On the completion of acknowledging all trouble events, the Trouble Queue Led illuminates steady.
2) A secondary means to view the trouble events shall be available via the up and down arrows. The Trouble Queue button shall return the display to the last acknowledged event.
3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.

4. On Monitor: The FACP interface shall display the first Monitor event with the ability to scroll to the subsequent Monitor events via the Monitor Queue button. The FACP interface shall on Monitor display the following:
a. The Monitor Queue Led flashes indicating a monitor status is present.
b. A custom message is displayed detailing location.
c. The display shall indicate the number of active Monitors present on the system.
d. The Monitor event status shall be identified as active or restored event.
e. Monitor event acknowledge sequence shall execute as follows:
1) The Monitor Queue button will sequentially step the operator through the monitor events, acknowledging the event on each Monitor Queue button depression. On the completion of acknowledging all monitor events, the Monitor Queue Led illuminates steady.
2) A secondary means to view the monitor events shall be available via the up and down arrows. The Monitor Queue button shall return the display to the last acknowledged event.
3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.

F. Paging Control: The FACP shall provide a minimum of sixteen programmable zone paging switches located in the FACP for selective zone paging.

G. Circuits
1. Signaling Line Circuits: NFPA 72, Class B, Style 4.
a. System Layout: Install no more than 80 percent capacity addressable devices on each signaling line circuit (not to exceed 100 devices per loop maximum).
2. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
a. Audible/Speaker Circuit: No more than 80 percent capacity.
b. Visual Circuit: No more than 80 percent capacity.
3. Actuation of alarm notification appliances, emergency voice communications, annunciation, smoke control, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown providing a break in the circuit will cause mechanical equipment to shut down.

H. Notification-Appliance Circuit: Operation shall sound in a three pulse temporal pattern.
1. A pre-recorded digital voice message, complying with ANSI S3.41 shall be provided.
2. Amplifier output voltage shall be 70 volts with speakers connected at 70 volts.

I. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password.

J. Voice/Alarm Signaling Service: A central emergency communication system with microphone, preamplifier, amplifier, and tone generator located in the FACP.

1. System shall be capable of indicating number of alarm channels for automatic, simultaneous transmission of different announcements to different zones, or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall be UL 1711 listed.
   a. Allow the application of and evacuation signal to indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
   b. Programmable tone and message sequence selection.
   c. Standard digitally recorded messages for "Evacuation".
   d. Generate tones to be sequenced with audio messages of the type recommended by NFPA 72 and that are compatible with tone patterns of the notification-appliance circuits of the FACP.
2. Status Annunciator: Indicate the status of various voice/alarm speaker zones.

K. Primary Power: 24VDC obtained from 120VAC service and a power-supply module. Initiating devices, notification appliances, magnetic door holders, signaling lines, trouble signal, supervisory signal shall be powered by the 24VDC source.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: Provide standby batteries with charger for operation of the system in the supervisory mode for up to 24 hours followed by a minimum of 5 minutes of an alarm condition in the event of power failure.

1. Batteries: Sealed lead calcium.
2. Battery and Charger Capacity: Comply with NFPA 72.

M. Surge Protection:

1. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

N. Event History Log: Minimum 300 event history log of alarm, trouble and sprinkler supervisory alarm conditions and shall be complete with one-man system walk test.

2.2 FIRE FIGHTER CONTROL PANEL (FFCP)

A. Manufacturer: National Time and Signal Corporation.

1. Model: A902-FFCP Series

B. General Description: Modular, power-limited design with electronic modules, UL 864 listed.

C. Alphanumeric Display and System Controls: Arranged for interface between the operator at the FFCP and addressable system including annunciation, paging and supervision of the system components. Displaying alarm, supervisory, trouble, monitor, status message, and providing a programming and control menu:

1. Annunciator and Display: Liquid-crystal type, two lines by 40 characters, minimum.
2. Keypad: Arranged to permit access and entry to a menu driven display for display and control of device enable/disable, device on/off control, one-man walk test, sensitivity reporting, history, and panel configuration.

D. FFCP User Interface: System events shall be stored in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have automatic priority viewing over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression. On the activation of a system event the following sequence shall occur:

1. On Alarm: The FFCP interface shall display the first alarm event with the ability to scroll to the subsequent alarm events via the Alarm Queue button. The FFCP interface shall on alarm display the following:
   a. The Alarm Queue Led flashes indicating an alarm status is present.
   b. A custom message is displayed detailing location.
   c. The display shall indicate the number of active alarms present on the system.
   d. The Alarm event status shall be identified as an active or restored event.
   e. Alarm event acknowledge sequence shall execute as follows:
      1) The Alarm Queue button will sequentially step the operator through the alarm events, acknowledging the event on each Alarm Queue button depression. On the completion of acknowledging all alarm events, the Alarm Queue Led illuminates steady.
      2) A secondary means to view the alarm events shall be available via the up and down arrows. The Alarm Queue button shall return the display to the last acknowledged event.
      3) The FFCP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
2. On Supervisory: The FFCP interface shall display the first supervisory event with the ability to scroll to the subsequent supervisory events via the Supervisory Queue button. The FFCP interface shall on supervisory display the following:
   a. The Supervisory Queue Led flashes indicating a Supervisory status is present.
   b. A custom message is displayed detailing location.
   c. The display shall indicate the number of active Supervisory(s) present on the system.
   d. The Supervisory event status shall be identified as active or restored.
   e. Supervisory event acknowledge sequence shall execute as follows:
      1) The Supervisory Queue button will sequentially step the operator through the supervisory events, acknowledging the event on each Supervisory Queue button depression. On the completion of acknowledging all supervisory events, the Supervisory Queue Led illuminates steady.
      2) A secondary means to view the supervisory events shall be available via the up and down arrows. The Supervisory Queue button shall return the display to the last acknowledged event.
      3) The FFCP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
3. On Trouble: The FFCP interface shall display the first Trouble event with the ability to scroll to the subsequent Trouble events via the Trouble Queue button. The FFCP interface shall on Trouble display the following:
   a. The Trouble Queue Led flashes indicating a Trouble status is present.
   b. A custom message is displayed detailing location.
   c. The display shall indicate the number of active Troubles present on the system.
   d. The Trouble event status shall be identified as active or restored event.

e. Trouble event acknowledge sequence shall execute as follows:
   1) The Trouble Queue button will sequentially step the operator through the trouble events, acknowledging the event on each Trouble Queue button depression. On the completion of acknowledging all trouble events, the Trouble Queue Led illuminates steady.
   2) A secondary means to view the trouble events shall be available via the up and down arrows. The Trouble Queue button shall return the display to the last acknowledged event.
   3) The FFCP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.

4. On Monitor: The FFCP interface shall display the first Monitor event with the ability to scroll to the subsequent Monitor events via the Monitor Queue button. The FFCP interface shall on Monitor display the following:
   a. The Monitor Queue Led flashes indicating a monitor status is present.
   b. A custom message is displayed detailing location.
   c. The display shall indicate the number of active Monitors present on the system.
   d. The Monitor event status shall be identified as active or restored event.
   e. Monitor event acknowledge sequence shall execute as follows:
      1) The Monitor Queue button will sequentially step the operator through the monitor events, acknowledging the event on each Monitor Queue button depression. On the completion of acknowledging all monitor events, the Monitor Queue Led illuminates steady.
      2) A secondary means to view the monitor events shall be available via the up and down arrows. The Monitor Queue button shall return the display to the last acknowledged event.
      3) The FFCP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.

E. Emergency Paging Control: The FFCP shall duplicate the programmable zone paging switches located in the FACP for selective zone paging from the FFCP emergency microphone.

F. The Fire Alarm system shall be capable of supporting the operation of five FFCP panels.

G. Dimensions: 14-1/2”W x 22”H x 4”D (Trim: 16-1/2”W x 24-1/4”H)

2.3 REMOTE ANNUNCIATOR PANEL

A. Manufacturer: National Time and Signal Corporation.
   1. Model: A902-ANNUN Series

B. Alphanumeric Display and System Controls: Arranged for interface between the operator at the FACP and addressable system including annunciation and supervision of the system components. Displaying alarm, supervisory, trouble, monitor, status message, and providing a control menu:
   1. Annunciator and Display: Liquid-crystal type, two lines by 40 characters, minimum.
   2. Annunciator User Control: Common control switches and LED's provided as a minimum shall be: RESET, ALARM SILENCE, PANEL SILENCE and DRILL.

C. Annunciator User Interface: System events shall be stored in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have automatic

priority viewing over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression. On the activation of a system event the annunciator shall mimic the event queue sequence of operation of the FACP and FFCP.

D. The annunciator shall be a single cabinet capable of both surface and semi-flush mounting with no additional hardware.

E. Dimensions: 14-1/2"W x 8"H x 3"D (Trim: 16-3/4"W x 10-1/4"H)

2.4 SYSTEM DETECTORS

A. General Description:
   1. Operation of smoke detector heads shall sound evacuation alarm through all speakers and open contacts in duct detector for fan shut down circuits. Alarm and trouble condition shall also be indicated at the FACP, FFCP and Annunicator. Each detector shall have a light to indicate activation and shall hold the signal of fire or smoke until manually reset.
   2. Smoke detectors shall be analog-addressable with digital transmission of sensor values.
   3. UL 268 listed, operating at 24-V dc, nominal.
   4. Smoke detectors shall communicate detector status (normal, alarm, or trouble) to the FACP.
   5. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
   6. Integral Visual-Indicating Light: Smoke detectors shall indicate detector status. When indicating light is not visible from the floor, a remote indicating light located in the ceiling or wall shall be installed.
   7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition.

B. Photoelectric Smoke Detectors:
   1. Manufacturers:
      a. National Time and Signal Corporation
         1) D900-PHOTO
   2. Sensor: LED or infrared light source with matching silicon-cell receiver.
      a. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
      b. Analog type with digital transmission of the sensor's value.
   3. Mounting: Plug-in base, interchangeable with smoke-detector bases.
   4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP, FFCP and Annunciator.
   5. Integral Visual-Indicating Light: Detectors shall indicate detector status.

C. Duct Smoke Detectors:
   1. Manufacturers:
      a. National Time and Signal Corporation
         1) D900-DD-PHOTO Series
   2. Photoelectric Smoke Detectors:
   3. Sensor: LED or infrared light source with matching silicon-cell receiver.

a. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

4. UL 268A listed, operating at 24-V dc, nominal.
5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
6. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
7. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
8. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
9. Relay Fan Shutdown: Provide one (1) set of contacts rated to interrupt fan motor-control circuit.
10. Duct smoke detectors shall include an addressable control module for fan shut-down and/or smoke/fire damper operation.
11. Duct smoke detectors shall include LED output terminals for connection to a remote indicator.

D. HEAT DETECTOR

1. Manufacturers:
   a. National Time and Signal Corporation
      1) Model D900-TEMP
2. Actuated by either a fixed temperature of 135
3. Mounting: Plug-in base, interchangeable with smoke-detector bases.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP, FFCP and Annunciator.
5. Integral Visual-Indicating Light: Detectors shall indicate detector status.

E. BEAM DETECTOR

1. Manufacturers:
   a. National Time and Signal Corporation,
      1) Model: SX-OSID Series Beam Smoke Detector
2. UL listed, operating at 24-V dc, nominal.
3. Mounting: Provide ceiling or wall mount capability complete with angular adjustment between the imager and emitter(s).
4. Dual Wavelength Particle Detection: The beam projected from each emitter shall employ a unique sequence of ultraviolent and infrared pulses utilized by the imager in the detection of a true smoke condition.
5. The SX-OSID dual wavelength particle detection sensing beam detector shall be capable of:
   a. Rejection of dust
   b. Rejection of intrusive solid objects
   c. Rejection of steam
   d. Rejection of unwanted light sources
6. Alignment: Capable of alignment using a laser positioning light source accessory.

7. The SX-OSID beam detector shall consist of one imager with sensing capability with up to seven remote emitters.
8. Emitters shall be powered by:
   a. 24-Vdc power source
   b. Wired-free battery source capable of 5-years of life with an end of life warning via the imager
9. Service: The imager shall be capable of providing service diagnostics showing pictorially the alignment to the remote emitters via an on device serial portal.
10. The reporting imager shall provide a retard and verification period for trouble and alarm sensing.

2.5 FIRE ALARM STATIONS

A. Manufacturers:
   1. National Time and Signal Corporation
      a. Model: 541S

B. Provide manufacturer recommended back box to accommodate pull station and addressable module.

C. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

D. Single-action mechanism with integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

E. Station Reset: Key operated switch.

F. Pull stations shall be mounted at 48" above finished floor.

2.6 ADDRESSABLE CONTROL MODULE

A. Manufacturers:
   1. National Time and Signal Corporation
      a. Model: D900-CTRL I/O Series

B. Provide for integration of auxiliary control functions into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:
   1. Communication interaction with the analog signaling circuit having the capability of initiating a control function to an auxiliary device based on a specified event.
   2. Provide NO/NC contact rated up to 4 amp 120 VAC or 24 VDC.

2.7 ADDRESSABLE MONITOR MODULES

A. Manufacturers:
   1. National Time and Signal Corporation
      a. Model: D900-MONITOR Series
      b. Model: D900-MINI Series

B. Provide for integration of the monitoring of dry contact devices into the analog signaling circuit.

2.8 ADDRESSABLE AUDIO/VISUAL MODULE

A. Manufacturers:
   1. National Time and Signal Corporation
      a. Model: D900-CTRL A/V Series

B. Provide for integration of audio and visual control zones into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:
   1. Communication interaction with the analog signaling circuit having the capability of initiating a control output to a notification device based on a specified event.
   2. Meets NFPA 72:
      a. Notification Circuit, class A or B / style Y or Z operation.
      b. Signaling Line Circuit, class A or B / Style 4, 6, and 7 operation.

2.9 INTELLIGENT NOTIFICATION APPLIANCE CONTROL (NACP) PANELS

A. Manufacturers
   1. National Time and Signal Corporation
      a. Model: D900-RPS-SG Series.
      b. Model: A901-NACP Series
      c. Model: A902-NACP Series

B. Furnish separately mounted addressable remote intelligent Notification Appliance control panels (NACP) complete with battery standby.

C. NACP panels shall connect to the DigiCommTM signaling line circuit and automatically report and display the following system fault conditions at the FACP, FARCP's and the remote annunciators. Each NAC circuit fault shall be required to identify the location of the circuit by way of a unique 40-character message. In addition, the NACP panel shall identify the location of the NACP panel by way of a 40-character message. The NACP shall be capable of annunciating the following trouble conditions.
   1. Processor Failure
   2. AC Power Failure
   3. Battery Fault
   4. Ground Fault
   5. Open Circuit for each NACP circuit.
   6. Short Circuit for each NACP circuit.
   7. Over current for each NACP circuit.
   8. Communication Fault

D. Notification Appliance Circuit (NAC)
   1. Each NAC circuit shall be capable of delivering 2.5 amps at 24 Vdc nominal.
   2. Each NAC circuit shall be capable of class A or B / style Y or Z operation.

E. Auxiliary Power Supply

1. Each NACP panel shall be capable of delivering 0.5 amps at 24 Vdc nominal.

F. Each NACP control panel shall have internal LED status indicators for individual fault conditions.

2.10 NOTIFICATION APPLIANCES

A. Manufacturers:
   1. National Time & Signal Corporation.
      a. Model: SG-CX(X)-SN Speaker Series
      b. Model: SG- SG-CX(X)-SS Speaker/Strobe Series
      c. Model: SG-NS Strobe Series

B. Description: Equipped for mounting as indicated and with screw terminals for system connections.
   1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
   2. Color: Red and White versions.

C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
   1. Rated Light Output: 15, 30, 60, 75, 110 candela on wall mounted strobes or 15, 30, 75, 95, 115 candela on ceiling mounted strobes, as required to meet NFPA 72 requirements.
   2. Strobe Leads: Factory connected to screw terminals.
   3. Strobe Lights shall be synchronized so that all strobes flash simultaneously.

D. Voice/Tone Speakers:
   1. UL 1480 listed.
   2. Low-Range Units: Rated 1/2 to 4 W.
      a. Tap all speakers at 1 watt, unless otherwise indicated.
      b. Tap all speakers at 2 watts in mechanical rooms.
   3. Mounting: Flush, semi-recessed, or surface mounted; bidirectional as indicated.
   4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.

2.11 CONDUIT AND WIRE

A. Conduit:
   1. Install conduit in accordance with the National Electrical Code, NFPA 70.
   2. Install all wiring in a conduit or raceway. Conduit fill shall not exceed 40 percent of the interior cross sectional area where three or more cables are included within a single conduit.
   3. Separate cables from any open conductors of Class 1 circuits and do not place in any conduit, junction box, or raceway containing Class 1 cables.
   4. Wiring for low voltage control, alarm notification, emergency communication, and similar power-limited auxiliary functions may be installed in the same conduit as initiating and signaling line circuits. Design system to permit simultaneous operation of all circuits without interference or loss of signals.

5. Conduits shall not enter the control panel or any other component provided except where entry is specified by the manufacturer.
6. Conduit shall be 3/4 inch minimum. All conduit for fire alarm wiring shall be painted by the manufacturer, color shall be red.
   a. Approved manufacturer of fire alarm conduit: Allied Tube & Conduit "True Color EMT"

B. Wire:
1. All fire alarm system wiring shall be new, plenum rated where required.
2. All cabling installed in open ceiling spaces shall be type FPLP, low smoke, fire resistant, metal clad cable, with red coloring. Cabling shall be per manufacturer's recommendation, and shall be able to power the strobes and speakers.
3. Wiring shall comply with local, state, and national codes and as recommended by the manufacturer. Number and size of conductors shall be as recommended by the manufacturer, but shall be not less than 18 AWG for initiating device and signaling line circuits, and 14 AWG for notification appliance circuits.
4. All wiring and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
5. All field wiring shall be supervised for open circuits, short circuits, and grounded conditions.

C. Control Panel: Connected to a separate dedicated branch circuit with a separate dedicated disconnect switch; circuit labeled FIRE ALARM.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Control and other panels shall be mounted with sufficient clearance for observation and testing.

C. All fire alarm junction boxes must be clearly marked for easy identification.

D. Flexible connectors shall be used for al devices mounted in suspended lay-in ceiling panels.

E. All conduit, mounting boxes, junction boxes and panels shall be securely hung and fastened with appropriate fittings to insure positive grounding throughout the entire system.

F. Smoke and heat detectors shall not be installed until after the construction clean-up is completed. Detectors installed prior to clean-up shall be cleaned by the manufacturer or replaced.

G. Pull stations and speakers installed in finished areas shall be mounted semi-flush and may be surface mounted on a recess mounted junction box in non-finished areas. Smoke detectors and thermal detectors shall be mounted on a recess mounted junction box in finished areas and to surface mounted junction boxes in non-finished areas.

H. Install manual stations with operating handle 4 feet above floor. Install audible and visual signal devices 6 feet 8 inches above the floor, or 6 inches below the ceiling, whichever is lower.

I. Use 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in conduit. All wiring shall be per manufacturer's requirements.

J. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be permitted in fire alarm conduits. Wiring splices are to be avoided to the extent possible, and if needed they must be made only in junction boxes and shall be crimp connected. Transposing or changing color coding or wires shall not be permitted. Wire nut-type connections are not acceptable. All conductors in conduit containing more than one wire shall be labeled on each end with "E-Z markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on all equipment panels.

K. Mount end-of-line device in control panel.

L. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.

M. Mount outlet box for electric door holder/release to withstand 80 pounds pulling force. Coordinate location with door contractor.

N. Make conduit and wiring connections to door holder/release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and duct smoke detectors.

O. Automatic Detector Installation: Conform to NFPA 72.

P. Adjust the audible alarms to 15dB above the ambient noise level, with a maximum setting of 120dB (per A.D.A. requirements).

3.2 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. Test in accordance with NFPA 72.

3.3 MANUFACTURER'S FIELD SERVICES

A. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.4 CERTIFICATION TESTING AND REPORTS

A. The contractor shall perform all electrical and mechanical tests required by the equipment manufacturer's certification form. All test and report costs shall be in the contract price. A checkout report shall be prepared by the installation technicians and submitted in triplicate, one copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:

1. A complete list of equipment installed and wired.
2. Indication that all equipment is properly installed and functions and conforms with these specifications.

3. Test of individual zones as applicable.
4. Serial numbers, locations by zone and model number for each installed detector.
5. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
6. Response time on thermostats and flame detectors (if used).
7. Name, certificate number and date.

B. After completion of all the tests and adjustments listed above, the contractor shall submit the following information to the Architect/Engineer:
1. "As-Built" routing layout diagrams including wire color code and/or tag number.
2. Complete "as-built" wiring diagrams.
3. Detailed catalog data on all installed system components.
4. Copy of the test report.
5. Submit final documentation, as required, to the State Fire Marshal.

C. Final tests and inspection shall be held in the presence of the Engineer. The contractor shall supply personnel and required auxiliary equipment for this test without additional cost.

D. The completed smoke detection system shall be tested to insure that it is operating properly. Acceptance of the system shall also require demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day test period.

E. Before final acceptance of work, the contractor shall deliver five copies of a composite "Operating and Shop Maintenance Manual." Each manual shall contain, but not be limited to: a statement of guarantee including date of termination and name and phone number of the person to be called in the event of equipment failure.

F. Individual factory issued manuals shall contain all technical information on each piece of equipment installed. In the event such manuals are not obtainable from the factory, it shall be the responsibility of the contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals.

G. Notify the Owner's Representative 3 working days in advance of tests. The tests shall be witnessed by the Owner.

H. Provide a written NFPA 72-1996 Form 7.2 test report, signed and dated, prior to acceptance of the fire alarm system by the Owner.

3.5 DEMONSTRATION

A. Demonstrate normal and abnormal modes of operation, and required responses to each.

B. SYSTEM TRAINING

C. Arrange for the Manufacturer to train the Owner's Fire Alarm Technicians on the operation and maintenance of the system. This training shall be equal to the training given to the Manufacturer's Field Service Technicians. If the Owner's Technicians have already received the operations and maintenance training, the training requirement will be waived.

D. Arrange for the Manufacturer to train the Owner's Fire Alarm Technicians on the system programming. This training shall be equal to the training given to the Manufacturer's Field Service Technicians. If the Owner's Technicians have already received the programming training, this requirement will be waived.

3.6 SYSTEM COMPLIANCE

A. Manufacturers:
   1. National Time and Signal Corporation
      a. Model Number ON-POINT FA 1000

B. Manufacturer to provide one year of On-Point™ System Compliance connection to include:
   1. Reporting of fire alarm events via text and/or email messaging.
   2. Remote event viewing of active and historical events via secure browser interface.
   3. Remote factory diagnostic support.

3.7 WARRANTY

A. All equipment and systems shall be warranted by the contractor for a period of one (1) year following acceptance. The warranty shall include parts, labor, prompt field service, pick-up and delivery.

END OF SECTION

SECTION 31 1000 – SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs and other vegetation to remain.

2. Removing existing trees, shrubs and other vegetation.

3. Clearing and grubbing.

4. Stripping and stockpiling topsoil.

5. Removing above-grade and below-grade site improvements.

6. Disconnecting, capping or sealing, and abandoning site utilities in place or removing site utilities.

7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 31 2000 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

2. Division 32 9200 Section “Turf and Grasses” for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

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

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site unless otherwise noted on the plans.

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 Closeout Procedures.

1. Identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

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 owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract. Contractor is to confirm that this authority has been obtained before beginning work on adjoining property.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 2000 Section "Earth Moving."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site. Contractor is responsible for doing an independent earthwork computation and including all necessary import and/or export of materials in their bid.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction. If said points will be disturbed, establish new points prior to removal.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and the sediment and erosion control drawings, whichever is more stringent.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls only after all areas are restored and stabilized.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.

2. Do not permit vehicles, equipment, or foot traffic within fenced area.

3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, 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 redirected and covered with soil.

3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.

4. 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 Engineer.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

2. Owner will arrange to shut off indicated utilities when requested by Contractor.

B. 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 Engineer not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

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. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.

4. Use only hand methods for grubbing within tree protection zone.

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 a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 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. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile topsoil material in locations approved by the Owner or Engineer.

3.7 SITE IMPROVEMENTS

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.

2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

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

1. Burning of materials on project property is prohibited.

END OF SECTION 31 1000

SECTION 31 1012 – 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.

B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

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 not in contract on the plans.

B. Related work specified elsewhere:

1. Division 31 2000 Section “Earth Moving.”

2. Division 32 9200 Section “Turfs and Grasses.”

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 Engineer 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 Engineer 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 inches and that soil contains enough organic matter to support and encourage rooting of seeded lawn.

PART 3 - EXECUTION

3.1 EXAMINATION

B. 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 Engineer or 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 Engineer. 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 Engineer'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 Engineer, 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, Engineer 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 one inch in 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 31 1012

SECTION 31 1018 – SOIL EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

A. The work under this Section includes, but not limited to 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, having jurisdiction.

B. Related Sections include the following:

1. Division 31 2000 Section “Earth Moving.”

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 other Specification Section in Part 3.

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 and the local enforcing agency.

C. Permits: Contractor is responsible for obtaining all pertinent permits including a Soil Erosion Control Permit if required from the county or local enforcing agency. Submit the NPDES Notice of Coverage when the soil erosion permit is received if not already done.

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. Use seed mix as indicated on the plans (if different seed mixes are indicated on the civil and landscape plans, the mix indicated on the landscape plans shall override). Critical areas shall be sodded as approved by the Engineer and as shown on the 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.

3. In all cases, seeding and mulching shall be performed within thirty (30) calendar 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.

5. Refer to the plans for notes regarding the use of turf reinforcement matting and/or mulch blankets (on all slope exceeding 1 vertical to 10 horizontal).

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 two (2) tons per acre, or equal, on all seeded areas that have a slope of less than 1 vertical to 10 horizontal. Refer to note A5. above for additional slope stabilization requirements.

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 calendar days.

3.4 STEEP SLOPES

A. Emulsion

1. On slopes greater than 10%, use erosion control blankets or turf reinforcement matting to hold seed in place. Refer to plan notes.

B. Other methods: Chemical self-adhering mulch and other mulch anchoring methods may be used as approved by the Engineer.

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.

9. Control site runoff during all periods of site construction to ensure that excess surface runoff does not reach adjacent properties. This is especially critical during stages when the land has been stripped but not yet graded.

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 31 1018

EARTHWORK

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.

1.2 SCOPE

A. The work under this section of the specifications shall consist of furnishing all labor, materials, equipment, transportation, and services required to complete all earthwork as indicated on the drawings and specified herein. Adjustment of grades may be permitted, subject to prior approval by the Landscape Architect, providing the overall grading concept is maintained.

1.2 QUALITY ASSURANCE

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

1.3 ENVIRONMENTAL REQUIREMENTS

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.

B. 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.

1.4 SAFETY CODES AND STANDARDS

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

1.5 LINES AND GRADES

A. The plans indicate lines, grades and elevations of the finish work. In general, areas to be paved shall be excavated and/or filled, and graded to the bottom elevations of such pavements. Grass areas shall be finish graded prior to seeding. Sod/seed areas shall be rough graded to 2" below finish grade prior to placement of topsoil.

1.8 PROTECTION OF EXISTING TREES & VEGETATION

A. Protect existing trees, and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stock piling construction materials or excavated materials within drip line, excess foot or vehicle traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing. Provide protection for roots over 1.5 inches in diameter that are cut during construction operations. Coat the cut faces with emulsified asphalt or other acceptable coating that is specially formulated for horticultural use on cut or damaged plant tissues. Temporarily

cover all exposed roots with wet burlap to prevent roots from drying out, provide earth cover as soon as possible. Repair or replace trees and vegetation damaged by construction operations in a manner acceptable to the Landscape Architect. Tree damage repair shall be performed by a qualified tree surgeon.

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, 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.

2.2 TOPSOIL

A. Existing onsite topsoil shall be screened and free of rock or gravel larger than 1” in any dimension, debris, waste, frozen materials, vegetable matter and other deleterious matter.

B. Topsoil to have 5% organic peat content.

C. Blend sand with screened topsoil to create a loamy-sand product**.**

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation consists of removal of material encountered to obtain required subgrade elevations.

1. Excavation for Ditches: Cut ditches to cross-sections and grades as shown. Deposit excavated materials a sufficient distance from the edge of ditches to prevent cave-ins or material from sliding into ditch. Keep ditches 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.
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. Stabilize earth subgrades under areas of paving and after excavating, but prior to filling, by discing four inches (4") deep and by compacting same as specified for fills. Remove soft or unstable soil below finish grade elevations and backfill such voids with compacted fill material.

3.2 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 AASHO 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.

3.3 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. 95% Modified Proctor where asphalt/concrete is to be placed.
   b. 80% Modified Proctor where topsoil is to be placed.

B. Placing Topsoil

1. Place to the following depths, up to finished grade elevations:
   a. Four inches (4") for sodded and seeded areas
   b. Use topsoil in relatively dry state. Place during dry weather.
   c. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of finish grades shown on the plans.
   d. Topsoil shall be worked to a smooth, uniform surface and compacted firmly. Any lumps or depressions which occur shall be regraded and re-rolled until a satisfactory grade is obtained. Areas adjacent to existing lawn shall be notched so new sod will be at the same grade. Immediately before seeding or sodding, rework the surface until it is fine, pulverized smooth seed or sod bed, varying not more than 1/8" in 10'.
   e. Remove all stones, roots, grass, weeds, debris, and other foreign material while spreading.
   f. Manually spread topsoil around trees, plants and buildings to prevent damage which may be caused by grading equipment.
   g. Compact placed topsoil to 85% Modified Proctor.

END OF SECTION 31 2000

SECTION 31 2001 – EARTH MOVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. All earthwork operations shall confirm to the current Michigan Department of Transportation standards and specifications.

C. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.

2. Subbase course for concrete walks and pavements.

3. Base course for asphalt paving.

4. Excavation and backfill for utility trenches.

B. Related Sections include the following:

1. Division 31 1000 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.

3. Division 33 4100 Section “Storm Sewers, Underdrains, and Drainage Structures” for storm drainage system.

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. Engineered Fill: Fill placed and compacted to densities specified herein, in a controlled manner using lift thickness limited herein, monitored and tested by the Testing Agency or independent Geotechnical Inspector.

G. Excavation: Removal of material encountered above subgrade elevations.

H. Fill: Soil materials used to raise existing grades.

I. 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.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. 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.

L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

M. Undercutting: Necessary excavation of poor quality soils which occur below the existing Topsoil and any uncontrolled fill soils as described in the Geotechnical Investigation.

N. 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 if required for the project .

2. Separation fabric if required for the project.

B. Test Reports: Testing Agency shall submit the following reports directly to the Engineer and shall copy the contractor:

1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and borrow materials.

2. In-place density test reports.

3. Moisture-density relationship test reports.

4. Compressive strength or bearing test reports.

C. Material Test Reports: 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 Agency Services

1. The 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 Engineer 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.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer or Owner and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer and Owner not less than three (3) calendar days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer'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 doing an independent earthwork calculation and including any import of appropriate fill material required to bring the site to the proposed grades.

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. GP (poorly graded gravel).
2. GM (silty gravel).
3. GC (clayey gravel).

4. SW (well-graded sand).
5. SP (poorly graded sand).
6. 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; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

1. Clean granular fill meeting MDOT Class II grading requirements.

2. On-site granular deposits within the excavation can be used as engineered fill if approved by the geotechnical engineer and if selective excavation procedures are employed to manage existing clay deposits.

3. Import fill as required to make-up volumes necessary to raise the building site.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; Generally either an MDOT 3G, 5G, 6A, or 34R will meet this

requirement. Bedding requirements of the agencies having jurisdiction over the utility installation take precedence over these specifications.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; Generally either an MDOT 6A or 34R will meet this requirement. Refer to the plans for specific requirements.

J. 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.

3.3 EXPLOSIVES

A. Explosives: Explosives are prohibited for use on the Project site.

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 Engineer and the correction thereof to the satisfaction of the Engineer 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 Engineer.

2. Unnecessary excavation other than under footings: Either place compacted fill or otherwise correct conditions, as required by the Engineer.

C. Approval of Subgrade: Notify the Testing Agency when required elevations have been reached.

1. When required by the Engineer 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 Engineer's or geotechnical engineer'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. Do not proceed with excavations for building structures until Subgrade Preparation operations are complete and tested.

B. 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.

C. Coordinate excavations with Dewatering operations as required to allow construction of foundations to dry.

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 a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade. Provide bedding course per the plan notes and/or details.

3.8 SUBGRADE PREPARATION AND INSPECTIONS

A. Perform mass earthwork operations to remove all existing topsoil and other organic materials in their entirety within the footprint of the proposed building and pavement areas. Buried objects should be removed in their entirety.

B. Notify Testing Agency when excavations have reached required subgrade elevations.

C. Proof-roll subgrade in the presence of the Testing Agency to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to the first direction. Limit vehicle speed to 3 mph.

2. Proof-roll subgrade with heavy pneumatic-tired equipment or loaded 10-wheel, tandem-axle truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Testing Agency, and replace with engineered fill as directed.

D. If Testing Agency determines that unsatisfactory soil is present, continue excavations and replace with compacted backfill or fill materials as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. 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.

3.11 BACKFILL

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.

3.12 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. 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. All pipe backfill to be done according to the details shown on the plans or the requirements of the regulating agency.

C. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

3.13 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use engineered fill.

3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.

5. Behind walls, use engineered drainage fill.

6. Under footings and foundations, use engineered fill.

7. Over excavated areas, 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 two (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 88 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.

C. Grading Inside Grading Lines: Finish subgrade to a tolerance of ½ inch, when tested with a 10 foot straight-edge.

D. Contractor shall confirm that the proposed grades shown on the plans will not create a ponding water condition (i.e. an unintended low spot or pavement grades of less than 1%).

3.17 SUBSURFACE DRAINAGE

A. Drainage Piping: Drainage pipe is specified in Division 33 Section 4100.

B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench. Place a 6 inch course of filter material on drainage fabric to support drainage pipe. Encase drainage in a minimum of 12 inches of filter material and wrap in a drainage fabric, overlapping sides and ends at least 6 inches.

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 of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.

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. If indicated on the plans or deemed necessary by the geotechnical engineer, 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 if fabric is called for on the plan or deemed necessary by the geotechnical engineer.

C. Under pavements and walks, place base on prepared subbase or subgrade as follows:

1. Place base course material over subbase (or subgrade if subbase is not indicated).

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, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches 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 wide, of satisfactory soil materials and compact simultaneously with each subbase and base layers 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, if indicated on the plans, place drainage fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

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 no less than 95 percent of maximum dry unit weight according to ASTM D 698.

2. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no more than 6 inches thick or less than 3 inches thick when compacted.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Construction Manager/Owner will engage a qualified independent Geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and to 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 and 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 becomes 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.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Unless otherwise indicated on the drawings, remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

1. Do not burn materials on the Owner's property.

END OF SECTION 31 2000

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, 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.
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 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 AASHO 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.

3.3 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.

END OF SECTION 31 2010

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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. For soil stabilization

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
Permitivity	.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

SEALING OF JOINTS IN RIGID PAVEMENT

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 1233 Plant Mix Bituminous Pavement
2. Section 32 3102 Chainlink Fence
3. Section 32 1836 Acrylic Tennis Court Surface

1.2 SCOPE

A. The work under this section shall consist of furnishing all labor, materials and equipment for the sealing of joints.

1.3 SUBMITTALS

A. Submit manufacturer's data sheets for all materials and all other related items to owner's representative.

PART 2 - PRODUCTS

2.1 JOINT SEALANT MATERIAL

A. This material shall be a fully pigmented system in-depth color to match specified acrylic tennis court surface. The material shall be as specified or approved equal:

1. NOVACAULK by Novasport USA, Framingham, MA (800) 872-6682
2. LATEXITE ACRYLIC CRACK COMPOUND by Surface Coatings Co., Auburn Hills, MI (248) 338-0335
3. CRACK FILLER by California Products, Cambridge, MA (800) 225-1141

B. The joint filler shall be of non-hazardous material, flexible and tolerant to movement in the pavement.

PART 3 - EXECUTION

3.1 APPLICATION

A. Clean joint so that it is free of all debris.

B. Use a blunt, snub-nose hand trowel, a broad knife, or similar tool to fill joint per manufacturer’s instructions.

C. Apply additional material as necessary.

D. Allow material to set and cure per the product manufacturers specified time before applying acrylic tennis court surface

END OF SECTION 32 0118

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 (5) 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 0.01% 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 F1551-03 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
1 1/2"	100
1"	90-100
¾"	60-80
½"	35-65
3/8"	18-45
¼"	17-35
No. 4	16-30
No. 8	14-25
No. 10	13-23
No. 16	10-20
No. 20	8-18
No. 30	5-18
No. 40	6-12
No. 50	4-10
No. 60	2-8
No. 100	1-4
No. 200	1-4
LBW	Maximum 4.0

Or

Aggregate Sieve Analysis	Percent Passing	
	Base Material	Finishing Stone
1 1/2"	90-100	
1"	75-100	
¾"	65-95	100
3/8"	40-75	85-100
¼"	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 F1551-03/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 pavement 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 recompacted, 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%, ± 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 AASHO 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.

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.

B. Related Sections:

1. Section 31 2000 Earthwork

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.

Aggregate Sieve Analysis	Percent Passing
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 AASHO 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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SECTION 32 1216 – HOT-MIX ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

1.2 SUMMARY

A. This Section includes installation of the following:

1. Hot-mix asphalt concrete paving.

B. Related Sections include the following:

1. Division 31 1415 Section "Pavement Marking."

2. Division 31 2000 Section "Earth Moving".

1.3 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. MDOT: Michigan Department of Transportation.

1.4 REQUIREMENTS

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of MDOT'S most current Standard Specifications for Construction. Where notes in this specification section differ from the MDOT standards, the MDOT standards shall govern.

B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

C. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

1.5 SUBMITTALS

A. Submit aggregate and bituminous mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the

engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with (MDOT) Michigan Department of Transportation's current Standard Specification for Construction for asphalt paving work.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.

2. Slurry Coat: Comply with weather limitations of ASTM D 3910.

3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Apply pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Cement: ASTM D 946.

B. Aggregate for Base Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

C. Aggregate for Leveling Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

D. Aggregate for Wearing Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

E. Fine Aggregate: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

F. Mineral Filler: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

G. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

B. Asphalt Cement: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

C. Prime Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

D. Prime Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

E. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

2.3 AUXILIARY MATERIALS

A. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

B. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.

C. Pavement-Marking Paint: Refer to section 32 1415 “Pavement Marking”.

1. Color: As indicated on Drawings or in accordance with MDOT.

D. Wheel Stops (if indicated): Precast, air-entrained concrete, 2500-psi minimum compressive strength, 6 inches high by 9 inches wide by 84 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 ASPHALT MIX DESIGNS

A. Hot-Mix Asphalt: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade and/or existing aggregate base course to remain is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subgrade, subbase and/or existing aggregate base course to remain using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Proof-roll as indicated in “Earth Moving” section 31 2000.

C. Verify that gradients and elevation of base are correct. Retain first subparagraph below, if applicable.

3.2 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch minimum or as indicated.

1. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared compacted subgrade and/or existing aggregate base course to remain is ready to receive paving.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

3.4 HOT-MIX ASPHALT CONCRETE PLACING

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

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.

2. Place hot-mix asphalt surface course in single lift.

3. Spread mix at minimum temperature of 250 deg F.

4. Install work in accordance with Michigan Department of Transportation (MDOT)..

5. Compact pavement by rolling to density specified. Re-roll as necessary to achieve even and smooth finish without roller marks.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.

2. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."

3.6 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.

2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.

2. Surface Course: 1/8 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Confirm minimum 1% slopes on asphalt pavement surfaces. Notify engineer prior to asphalt placement if minimum 1% slope is not met in any areas.

3.8 PAVEMENT MARKING

A. Refer to specification section 32 1415 “Pavement Marking”.

3.9 FIELD QUALITY CONTROL

A. Testing and inspecting: Owner may secure a testing firm to perform and determine compliance with specified requirements and AI MS-2.

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 1216

PLANT MIX BITUMINOUS PAVEMENT

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 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 measure 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 - MATERIALS

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 unless other materials cannot be obtained. Only blast furnace slag is acceptable in this case. No R.A.P. material permitted.
5. MDOT Mix: 1100 L - 20AA

Aggregate Sieve Analysis	Percent 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.

1. Thickness: Not less than 1 ½" inches when compacted
2. Liquid Asphalt/Bitumen: 5% ~ 9% by weight (±1½%)
3. Asphalt Penetration or Type: (PG-58-28)
4. Aggregate Type: Crushed limestone or natural aggregate. Slag is unacceptable unless other materials cannot be obtained. Only blast furnace slag is acceptable in this case. No R.A.P. material permitted.
5. MDOT Mix: 1100 T - 36-A

Aggregate Screen Size	Percent 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 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.

3.3 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.

3.4 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.

3.5 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

3.6 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. The plant mix bituminous material shall be compacted to 95% of the bulk density as determined by 50 blows-per-side Marshall procedures.

D. 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 1218

SECTION 32 1313 – CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

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 31 1415 Section “Pavement Marking.”

2. Division 31 2000 Section “Earth Moving” for subgrade preparation, grading and subbase course.

1.3 PERFORMANCE REQUIREMENTS

A. Refer to MDOT’s current Standard Specifications for Construction.

1.4 SUBMITTALS

A. Submit aggregate and concrete mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

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 and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

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.

1.6 PROJECT CONDITIONS

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, deformed billet steel, unfinished.

C. Epoxy-Coated Reinforcement Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, deformed bars.

D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. 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, plain steel bars.

G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

H. Hook Bolts: ASTM A 307, Grade A, 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. All material to meet current MDOT specifications.

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. 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: ½ 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: n/a

C. Wheel Stops (use only if indicated on the plans): Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate.

1. Dowels: Galvanized steel, diameter of 3/4 inch, minimum length 18 inches.

D. 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.

E. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

F. 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 for driveways, roads, parking lots, curbs and gutters with the following properties:

1. Compressive Strength (28 Days): 3500 psi, unless otherwise indicated.

2. Maximum Water-Cementitious Materials Ratio: 40% by weight.

3. Slump Limit: 3 inches.

4. Maximum Aggregate Size: 1.5 inch (38 mm).

D. Sidewalks and platforms provide 3500 psi.

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

F. 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.

G. Use appropriate treatment per MDOT specifications where concrete will be placed under freezing conditions. Obtain approval of Engineer prior to placing concrete in freezing conditions.

H. 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 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

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 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. At all locations where new concrete abuts existing concrete, building wall, or supported slabs, place expansion joint and joint sealant.

C. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

D. 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. Terminate joint filler 1 inch below finished surface to allow placement of joint sealant.

2. Joint sealant is required for all projects even if not indicated on the plans.

E. Expansion Joints: Place 1 inch (25 mm) wide expansion joints at maximum 40 foot intervals, if not indicated on drawings. Joints to be full depth of pavement. Place joint sealant at all expansion joints.

F. Install dowel bars and support assemblies at joints if indicated on the plans. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

G. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas. Construct ¼ inch wide contraction joints for a depth equal to at least one-third of the concrete thickness. Maximum spacing of contractions joints shall be 8'.

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch (10-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

H. 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 screeding, 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.

C. Provide detectable warning surface at all handicap ramps to meet ADA requirements in accordance with ANSI sections 406.13 and 705.

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 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.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.

3. Surface Variation: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.

4. Maximum cross slope for walks, ramps, platforms: 2%

5. Maximum longitudinal walk slopes not requiring landings and handrails: 5%

6. Maximum longitudinal ramp slopes: 8.33% (1 on 12 slope)

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. 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.

1. If indicated on the plans, spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will 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., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.

C. Test results shall be reported in writing to Engineer, 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.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements as directed by the Engineer.

B. Remove and replace concrete sidewalks and/or ramps that do not comply with maximum slopes indicated in Section 3.8A above.

C. Protect concrete from damage. Exclude traffic from pavement for at least fourteen (14) calendar days after placement.

END OF SECTION 32 1313

SECTION 32 1373 – CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern

1.2 SUMMARY

A. General – all expansion joints are to receive joint sealant. Contraction and other joints receive sealant only if indicated on the plan.

B. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

2. Joints between cement concrete and asphalt pavement.

C. Related Sections include the following:

1. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.

2. Division 32 Section "Cement Concrete Pavements" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data, shop drawing submittals are not required. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

2. When joint substrates are wet or covered with frost.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Use products meeting MDOT’s current specifications.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: Gray.

2.3 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Products:

a. Crafco Inc.; RoadSaver Silicone.

b. Dow Corning Corporation; 888.

c. Approved equal.

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Products:

a. Crafco Inc.; RoadSaver Silicone SL.

b. Dow Corning Corporation; 890-SL.

c. Approved equal.

2.4 HOT-APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Products:

a. Crafco Inc.; Superseal 444/777.

b. Meadows, W. R., Inc.; Poly-Jet 3406.

c. Approved equal.

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Products:

a. Koch Materials Company; Product No. 9005.

b. Koch Materials Company; Product No. 9030.

c. Meadows, W. R., Inc.; Sealtight Hi-Spec.

d. Approved equal.

2.5 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.

2. Do not stretch, twist, puncture, or tear backer materials.

3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

END OF SECTION 321373

SECTION 32 1415 – PAVEMENT MARKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section.

B. These specifications apply to private, on-site pavement marking. All pavement markings within public rights-of-way must comply with the standards of the regulating agency.

1.2 SUMMARY

A. The work under this section includes, but is not necessarily limited to the furnishing and installation of all materials necessary for placing pavement markings as indicated on drawings and specifications.

1. Markings on concrete pavement areas.

2. Markings on asphalt pavement areas.

3. Markings on existing concrete or asphalt areas.

4. Markings on resurfaced existing pavements.

B. Related Sections include the following:

1. Division 32 1216 Section “Hot-Mix Asphalt Concrete Paving.”

2. Division 32 1313 Section “Cement Concrete Pavements, Curbs and Gutters.”

1.3 QUALITY ASSURANCE

A. MDOT Specifications: Unless otherwise indicated on drawings or herein specification, all work under this section shall be performed in accordance with the current MDOT Standard Specifications for Highway Construction.

B. Physically Handicapped: All marking shall be done in accordance with ADA Requirements.

C. Paint Containers: Each paint container shall be plainly marked, with a durable, weather-resistant marking, showing the name and address of manufacturer or vendor, description of material, batch number, date of packaging and volume and weight of contents.

D. Use only personnel completely trained and experienced in installation of materials and equipment.

1.4 SUBMITTALS

A. Product Data, shop drawing submittals are not required. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.5 PRODUCT HANDLING

A. Protection: Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and products for work under this section shall conform to current 1990 MDOT Standard Specifications for Highway Construction.

2.2 PAVEMENT MARKING PAINT

A. Pavement marking paint shall be fast dry and comply with MDOT's current Standard Specifications for Highway Construction and shall be selected from the following list of approved products (or equal).

Company	Identification	YELLOW	WHITE
Baltimore Paint & Chemical Co.		BP29-56/TM9451	BP29-55/TM9450
DeSantis Coatings, Inc.		12Y-D194/K663	
Ennis Paint Mfg., Inc.		EN-6055	EN-4038
Ennis Paint Mfg., Inc.		EN-6054	
Prismo Universal Corporation		LW86-24D	LW84-95A

B. Provide required colors for all physically handicapped markings, complying with governing agencies having jurisdiction.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection: Prior to all work of this section, carefully inspect installed work of all trades and verify all such work is complete to the point where installation may properly commence. Verify all

pavement markings may be installed in accordance with all pertinent codes and regulations, authorities having jurisdiction and referenced standards.

B. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancies until all have been fully resolved.

3.2 SURFACE PREPARATION

A. Cleaning: Prior to application of pavement marking, it shall be marking contractor's responsibility that pavement surfaces are clear, dry and free of all foreign materials.

B. New pavement curing: new bituminous wearing surface shall be in place for period of not less than fourteen days prior to application of Fast Dry pavement markings.

3.3 CONSTRUCTION METHODS

A. Application: Pavement markings shall be solid 4" wide yellow lines and laid out as indicated on drawings. Paint shall be applied uniformly at a minimum rate of sixteen gallons per mile for single 4" solid line. Markings shall be applied so that they adhere adequately to surface.

B. Protection of wet paint shall be responsibility of contractor. Markings obliterated by traffic shall be retraced at contractor's expense.

3.4 DEFECTIVE WORK

A. Improper location: Improperly located markings shall be removed at contractor's expense in a manner acceptable to Engineer and reapplied in correct locations at contractor’s expense.

B. Material shortage: Markings which are applied with material shortages shall be properly reapplied at contractor's expense.

3.5 CLEAN UP

A. Upon completion of the work of this section, remove all rubbish, trash and debris resulting from work of this section. Leave site in neat and orderly condition.

END OF SECTION 32 1415

SYNTHETIC TURF

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, tools and equipment necessary to install, in place, all synthetic turf materials as indicated and specified herein. The materials shall be provided and installed in strict accordance with the manufacturer's written instructions and in accordance with all details and approved shop drawings. The scope of work shall include:

1. Parallel slit polyethylene fiber tufted into a fiber reinforced polyester-polypropylene backing with a secondary backing of polyurethane, synthetic turf system. Infill system shall be recycled SBR rubber.
2. Inlaid football yardlines, inbound lines, and touchline lettering.
3. Inlaid soccer lines
4. Maintenance Equipment
5. Manufacturer's Warranty – Guarantee (8 Years)
6. 3rd Party Insured Warranty

1.3 QUALITY ASSURANCE AND REFERENCE STANDARDS

A. 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.

B. Builder/Installer Experience:

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.

C. 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

D. 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

E. POST-INSTALLATION TESTING:

1. Following, 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

2. 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.

    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

F. REFERENCE STANDARDS:

1. 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
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)

G. RESUMES: Upon request, Bidder shall submit resumes detailing level of experience of each installation foreman or supervisor.

H. 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.

I. 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.

J. 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.

K. 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.

L. FIELD DIMENSIONS: Turf Provider is responsible for verifying field size and layout of markings and dimensions to verify conformity to specifications and governing standards.

M. 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:
   a. Acceptable uses for the field
   b. Fading
   c. Color match within specifications
   d. Excessive fiber wear
   e. Wrinkling and panel movement
   f. Shock absorbency (G-max)
   g. Seam Integrity
   h. Drainage (of Carpet and Infill only)
   i. Flammability
   j. Response time for required repairs/replacement
3. Results of G-max shall not deviate by more than 10%. See chart below.

Football Field	6 pts
Average Initial G-max (w/o E-layer)	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 ½ of the turf fiber.

N. 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.
      i. Provide a minimum of 300sf of each color installed on the field. This shall be from the usable remnants generated during installation.
   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. Six 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 **Clawson Public Schools.**
7. Provide test reports, conducted by an independent (third-party) laboratory, on 5 random carpet rolls. Reports shall comply with the ASTM tests as follows:
   a. ASTM D418 or D5848 - Pile Height, Face Width & Total Fabric Weight
   b. ASTM D418 or D5848 - Primary & Secondary Backing Weights
   c. ASTM D1335 - Tuft Bind
   d. ASTM D1682 or D5034 - Grab Tear Strength
   e. ASTM F1015 - Relative Abrasiveness
   f. ASTM D2859 - Pill Burn Test (4 tests: each with passing result)
   g. ASTM F2765- Total Lead Content in Synthetic Turf Fiber
8. 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.
9. 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 unit shall be equivalent to "Greens Groomer" Model # 720SDE as manufactured by GreensGroomer World Wide, Inc, Indianapolis, IN (888) 613-6993.
   b. Sweeper unit shall be:
      i. "Litter Kat" with magnet by GreensGroomer World Wide, Inc, Indianapolis, IN (888) 613-6993
      ii. "Crewzer Junior" by Pioneer Athletics, Cleveland, OH (800) 877-1500
   c. 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, or glued to a supplemental backing material.

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, as manufactured by TTC/Polylom. The low friction fiber, TTC's XP Pro, shall be specifically designed to virtually eliminate abrasion.
2. The fiber weight shall not be less than 42 ounces per square yard. The overall product weight must not be less than 74 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 fiber s in place. Products using latex based secondary backings will not be acceptable. The synthetic grass system shall be perforated with 1/4" holes every four (4") inches in both directions 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 numbers, football and soccer markings and centerfield/endzone graphics shall be permanently inlaid unless otherwise indicated.
6. The primary fiber color shall be Field Green in color to simulate natural grass as closely as possible and treated with UV inhibitor, guaranteed a minimum of eight years.
7. The all rubber infill system 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
    d. The CRI used as infill shall conform to the following chemical analysis:

TEST	ASTM TEST METHOD	MAX.	MIN.
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. Synthetic Turf Physical Characteristics

Physical Properties:	Minimum Specification Requirements
Pile Ht	2.25”
Pile Ribbon Wt	42 oz./sy
Primary Backing Wt	8 oz./sy
Secondary Backing Wt.	24 oz./sy
Total Face weight	74 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	●Bonar Yarns & Fabrics ●TTC/ Polyloom
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

9. Rubber Mesh

*Mesh (ASTM E-11)

Sieve Size	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%

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 surface fully warranted for the period and conditions specified herein. 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 or glued to a supplemental backing material.
b. All turf terminal edges shall be stapled/nailed.
c. Turf inlays as indicated on the drawings shall be glued

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 or glued to a supplemental backing material.

G. EDGES: Extents of turf 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 ± 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 to a supplemental backing.

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 with a two-part, high strength polyurethane adhesive applied per the Turf Manufacturer's standard procedures for outdoor applications. Shaving of inlays will not be allowed.

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 CLEAN UP

A. Contractor shall provide all labor, materials and equipment necessary for final cleaning of surfaces and installed items.

B. Contractor shall keep working area clean throughout the project and upon completion, shall clean working area for immediate occupancy and use by the Owner.

END OF SECTION 32 1813

SAMPLE SYNTHETIC TURF WARRANTY

1.1 Warranty

A. System Installer/Manufacturer ("_____") hereby warrants to Clawson 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 Clawson 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. System Installer/Manufacturer further warrants that the synthetic turf located along the players and coaches areas, along both sides of the fields, will stay attached at the seams for an additional two (2) years after the eight (8) year term of this warranty expires. This in no way implies that the color fastness of the synthetic turf will be warranted for these same additional two (2) years.

C. System Installer/Manufacturer warrants to Clawson 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).

I. System Installer/Manufacturer shall be allowed to examine the synthetic turf system regarding any claim which Clawson Public Schools makes, to be present at and to analyze the results of all tests conducted by Clawson Public Schools or others, and to conduct such tests incurred by Clawson Public Schools or others with respect to such tests.

J. All claims made by Clawson 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: CLAWSON PUBLIC SCHOOLS DATE: _____

BY: _____

CONTRACTOR: DATE: _____

BY: _____

MANUFACTURER: DATE: _____

BY: _____

ACRYLIC TENNIS COURT 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 1218 Plant Mix Bituminous Pavement
2. Section 32 3100 Chainlink Fence

1.2 SCOPE

A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary for acrylic tennis court surfacing and line markings.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Sports Builders Association (ASBA)

B. The installation contractor must be able to supply the Owner, upon request, a list of twenty (20) outdoor tennis courts surfaces with the material accepted over the last five (5) years and have required no maintenance.

1.3 SUBMITTALS:

A. Contractor shall submit manufacturer's data sheets and color samples for all materials.

B. Contractor must submit copies of the Material Data Safety Sheets (MSDS) for all products to be used, before materials are delivered to the site.

PART 2 - PRODUCTS

2.1 TENNIS COURT SURFACE MATERIAL

A. This material shall be a fully pigmented system in-depth color. The material shall be from one of the following approved manufacturers:

1. NOVACOURT, by Novasport USA, Framingham, MA (800) 872-6682
2. DECO SURFACING, by California Products, Cambridge, MA (800) 332-6178
3. LATEXITE, by Surface Coatings Co., Auburn Hills, MI (248) 338-0335
4. PLEX-PAVE, by California Products, Cambridge, MA (800) 225-1141
5. LAYKOLD, by Advanced Polymer Technology, Harmony, PA (888) 266-4221
6. SportMaster Sport Surfaces by Seal Master, Sandusky, Ohio 800-326-1994

B. Acrylic Coloring of Courts to be selected by owner. Contractor shall provide standard color options.

C. Asphalt or tar in any form will not be permitted in any coating. The color shall be pure acrylic-type containing no asphalt or tar emulsions and no vinyls, alkyds or non-acrylic resins. The color finish system shall contain factory-mixed compositions requiring only the addition of water on the job site. The material shall be delivered to the site in sealed containers with the manufacturer's label affixed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Plant Mix Bituminous Asphalt shall cure for a minimum of 14 days prior to application of surfacing materials.

B. The asphalt surface shall be flooded, and any ponding water that remains after 1 hour and is deep enough to cover the thickness of a five cent piece shall be corrected using a patch mix by the approved surfacing manufacturer. Ambient air temperature to be +/- 70 degrees.

C. Tennis courts shall be cleaned using a stiff bristle broom and a gas-powered, water based pressure spray unit capable of generating 2500 psi. at the nozzle tip, to remove all dirt and debris.

D. Saw-cut control joints at the net line and equal distant between the courts, as detailed, using a dry cut blade. Power wash area sufficiently to allow adhesion of acrylic color system.

E. After all leveling and patching, the tennis court area shall receive one (1) coat of sand filled acrylic surfacer material at the rate of .07 gallon/square yard.

F. Application of the system shall be in strict accordance with the printed instructions of the manufacturer. If the system is installed by someone other than the manufacturer, an experienced manufacturer's representative shall supervise the installation of the material.

G. The surface to receive the tennis surface system as specified shall be checked to be free from grease, oil and other foreign materials before starting the work. The Contractor shall remove by brush, vacuum or blower all dust, dirt, imbedded soil, etc. and shall mechanically wash areas, if required.

H. Holes, cracks and spalled areas shall be clean of dirt, water and deleterious materials before any coating operations are started. After cleaning and treating these areas with the proper filler materials, the application shall proceed only if the surfaces are dry and clean and the temperature is at least fifty degrees Fahrenheit (50°F). and rising and the surface temperature is not in excess of one hundred forty degrees Fahrenheit (140°F).

I. Apply two (2) filler coats and one (1) finish coat. Application shall be in strict accordance with manufacturer's specifications. The material shall have in-depth color in the color combinations as indicated for the final surface.

J. The filler coat shall be applied at a rate of .05 gallons (concentrated material prior to dilution) per square yard for each coat. The final surface shall be applied at a rate of .04 gallons (concentrated material prior to dilution) per square yard. Only small amounts of water shall be added if too rapid drying is occurring during application. The Contractor shall be accountable at all times for the amount of materials of each color used. Permission of the Landscape Architect shall be obtained before adding any additional water.

K. Care shall be taken to protect adjacent areas and structures (fences, posts, sidewalks, buildings, etc.) which are not to be coated. If coated, remove immediately before drying occurs.

L. Contractors must notify the Landscape Architect of all applications, 48 hours prior to installation.

M. Acceptability of work: The finished surface shall be constant in color and texture, free from voids, depressions, joint marks, ridges, wheel marks or other imperfections. If any of these become apparent during the installation of the system, the contractor will correct prior to the final coat application, or the surface shall be rejected.

3.2 LINE MARKINGS

A. Upon completion and acceptance of the tennis surface, this Contractor shall prepare and paint lines for tennis. Unless otherwise noted, tennis lines shall be white.

B. The lines shall be masked on both sides with an acceptable tape. Each measurement shall be accurately set to within 1/8" tolerance in accordance with the American Sports Builders Association (ASBA). Each court area shall be marked for doubles play.

C. All areas that have overlapped in color shall be corrected and non-appearing. All overspray in excess shall be corrected and non-appearing. No spraying shall be done with the wind factor above seven (7) mph.

END OF SECTION 32 1834

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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, turnstiles and all related hardware.

1.3 QUALITY ASSURANCE AND WARRANTY GUARANTEE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM A116 – Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
   b. ASTM A120 – Standard Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded Seamless Pipe
   c. ASTM A491 – Standard Specification for Aluminum Coated Steel Chain Link Fence Fabric
   d. ASTM C94 – Standard Specification for Ready-Mixed Concrete
   e. ASTM F567 – Standard Practice for Installation of Chainlink Fence
   f. ASTMF900 – Standard Specification for Industrial and Commercial Swing Gates

B. Weights and tolerances to conform to Federal Specification RR-F-191G, dated January 25, 1974. Mill certificates shall be made available at the request of the Landscape Architect or Owner.

C. The Contractor and any Sub-Contractor hereunder guarantee their respective work against defective materials or workmanship for a period of two (2) years from the date of filing Certificate of Substantial Completion and as accepted by the Owner.

D. 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 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacturing of products specified in this section with a minimum of ten (10) years experience

B. Installer: Company specializing in performing work of this section with a minimum of five (5) years experienced.

1.5 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.

1.6 SUBMITTALS

D. Shop drawings showing plan layout, spacing of components, post foundation dimensions, hardware, gates and schedule of components.

E. Product Data: Submit product data on fabric pattern, posts, accessories, fittings, and hardware.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framing Steel: ASTM F1083 Schedule 40 galvanized steel pipe weighing three and sixty-five one-hundredths (3.65) lbs. per lineal foot or SS-30 galvanized steel pipe weighing three and sixty-five one-hundredths (3.65) lbs. per lineal foot.

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: For general fencing, the chain link fabric shall be 2" mesh, 9 gauge. For the tennis courts, the chainlink fabric shall be 1-3/4" 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 ½". The chain link fabric shall be tied to the line posts with No. 9 gauge annealed galvanized steel tie wire. Line posts for general fencing shall be installed in 3" sleeve, set in concrete footing. Top of sleeve shall be flush with proposed grade. Line posts for tennis courts fencing shall be pneumatically driven. Refer to Part 3 Execution.

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. For general fencing, terminal and gate post shall be installed in 4" sleeve, set in concrete footing. Sleeve shall be filled with hydraulic cement (Quik-Rock) to prevent posts from turning. Top of sleeve shall be flush with proposed grade.

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 and Bottom Rail: 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 (2.27) 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 and bottom 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, and bracing rails shall utilize fully closed rail caps.

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. 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 for tennis courts shall be driven. Line posts for general fencing shall be sleeved and set in concrete footing.
3. Refer to Chart in Section 3.2, A.

H. 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 heavy-duty latching devise 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.

2.3 TURNSTILE

A. Turnstiles shall be Model Turnlock-100ES (2) (non-electric, lockable, two directional), manufactured by Boon Edam, (800) 334-5552, www.boonedam.com, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not construct fence until site grading is complete.

3.2 INSTALLATION

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

1. Corner/Terminal, Bracing and Line 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. Corner/Terminal, Bracing and Line Post Sleeve Size- General Fence

Post Size	Sleeve Size	Post Depth	Diameter of Foundation	Foundation Depth	Maximum Spacing
3”	4”	36”	12” min	42”	10’-0”
2-1/2”	3”	36”	12” min	42”	10’-0”

3. Corner/Terminal, Bracing and Line Post – Tennis Courts

Fabric Height	Post Depth	Diameter of Foundation	Foundation Depth	Maximum Spacing
6’-1” - 12’-0”	36”	12” min	42”	8’-0”

4. Line posts for tennis courts shall be pneumatically driven into the ground using the following chart*:

Fabric Height	Pipe Below Grade	Total Length of Post
10’	7’	17’

B. Fence posts shall be installed with maximum 6 inches clear opening from end posts to buildings, fences, property lines or other structures.

C. 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.

D. Turnstile shall be installed as per manufacturer recommendations.

E. Top of concrete footing shall be left down and topped with surrounding pavings as detailed. 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

SECTION 32 9200 – TURFS AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Turf Renovation.
3. Sodding.

B. Related Sections:

1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.
3. Division 32 Section “Fine Grading” for final grades for planting.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

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

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety,

and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

C. Certification of Bio-Retention Area Seed: From seed vendor for each bio-retention-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Product Certificates: For fertilizers, signed by product manufacturer.

E. Qualification Data: For landscape Installer.

F. Material Test Reports: For imported topsoil.

G. Planting Schedule: Indicating anticipated planting dates for each type of planting.

H. Maintenance Instructions: Recommended procedures to be established by Contractor for the Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; location exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.7 SCHEDULING

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 1st and June 1st.

2. Fall Planting: September 15th and October 15th.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

b. A minimum of two (2) lawn cuttings (MANICURED LAWN ZONES ONLY) will be completed before the owner takes over maintenance.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water lawn at a minimum rate of 1 inch per week.

D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow grass to 2 inches height.

E. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Apply Type B fertilizer to lawns approximately 30 days after seeding

at a rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft.

(140 lbs./acre). Apply with a mechanical rotary or drop type distributor.

Thoroughly water into soil. (Provide 3 applications)

F. Weed Control: 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.

G. Apply fungicides and insecticides as required to control diseases and insects.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

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

1. Lesco (248) 689-5005

2. Rhino Seed & Supply (800) 482-3130

3. Michigan State Seed Solutions (800) 647-8873

C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. General Seeded Lawn Areas (for lawn restoration areas only):

a. 50 percent Kentucky Bluegrass, a minimum of (3) three cultivars

b. 50 percent Perennial Ryegrass, a minimum of (2 or 3) two or three cultivars.

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars

2.3 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.5 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.6 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.7 FERTILIZER

A. Granular, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis professional fertilizer.

1. Type A: Starter fertilizer containing 11% nitrogen, 23% phosphoric acid, and 10% potash by weight or similar approved composition.

2. Type B: Top dressing fertilizer containing 31% nitrogen, 3% phosphoric acid, and 10% potash by weight or similar approved composition.

a. Apply Type A fertilizer at initial sowing of seed and a Type B fertilizer application 4 weeks after initial germination.

b. (Provide a min. one (1) Type A fertilizer application and three (3) Type B fertilizer applications)

2.8 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

D. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.9 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

2.10 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments in the following quantities:

PLANTING BEDS:

1. Three parts well-drained screened organic imported topsoil to one part clean imported sand to one part Canadian sphagnum peat moss, to one part natural compost (weed-free).

LAWNS:

2. Manicured Lawns shall use screened stock-piled topsoil from specified on-site location.

2.11 SEEDING

A. General: Provide grasses for seeding.

2.12 MATERIALS

A. Topsoil for Seeding Lawn Areas.

B. Seed: Fresh, clean and new crop seed mixture. Mixed by approved methods.

C. Composed of the following varieties, mixed to the specified proportions by weight and tested to minimum percentages of purity and germination.

D. Seed Mixture: Proportioned by weight as indicated below:

1. Type 1: All Sports Mix

	Proportion	Minimum Purity	Minimum Germination
Merit Kentucky Bluegrass	25%	95%	80%
Baron Kentucky Bluegrass	25%	95%	80%
Manhattan II Turf Type Rye	50%	95%	80%

a. Spread at a rate of 4-5 lbs./1000 sf.

2. Type 2: All Sports Mix

	Proportion	Minimum Purity	Minimum Germination
Wrangler Turf Type Tall Fescue	40%	95%	80%

Newport Kentucky Bluegrass	40%	95%	80%
Allaire II Perennial Rye	20%	95%	80%

a. Spread at a rate of 6-7 lbs./1000 sf.

b. No noxious weed seeds permitted.

3. Type 3: Lawns

All Sports Mix	Proportion	Minimum Purity	Minimum Germination
Merit Kentucky Bluegrass	40%	95%	80%
Creeping Red Fescue	30%	95%	80%
Nite Hawk Perennial Rye Grass	30%	95%	80%

a. Spread at a rate of 4-5 lbs./1000 sf.

b. No noxious weed seeds permitted.

4. Type 4: “Low-Mow”

All Sports Mix	Proportion	Minimum Purity	Minimum Germination
Chewing Fescue	24.5%	95%	80%
Axay Sheep Fescue	24.5%	95%	80%
Brigade Hard Fescue	24.5%	95%	80%
Creeping Red Fescue	12.5%	95%	80%
Dawson Red Fescue	12.5%	95%	80%
Inert matter	1.70%		
Other crop seed	0.30%		

a. Sow seed at 5 lbs/1000 sf.

b. No noxious weed seeds permitted.

E. Fertilizer: 13-25-12. Granular, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis, professional fertilizer.

F. Ground Limestone: Used if required by soil test report. Containing not less than 85% of total carbonates and ground to such fineness that 50% will pass through a 100 mesh sieve and 90% will pass through a 20% mesh sieve.

G. Granulated sulfur 0-0-0-90 to lower pH. Use if determined by soil tests to be necessary. Apply per soil test recommendations at specified rate.

H. Straw Mulch: Used in crimping process only. Clean oat or wheat straw well seasoned before bailing, free from mature seed-bearing stalks or roots of prohibited or noxious weeds.

I. Water: Free of substance harmful to seed growth. Hoses or other methods of transportation furnished by Contractor. Test for excess Alkalinity, if necessary.

J. Wood Cellulose Fiber Mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable to hydra-mulching.

1. AVAILABLE MANUFACTURER AND TYPE:

2. CONWED HYDROMULCH: CONWED CORP., ST. PAUL, MN

3. CELLIN HYDROMULCH: CELLIN MFG. INC., LORTON, VA

K. Paper Mulch: Degradable paper mulch, free of foreign debris. Do not use on slopes over 30%. Available manufacturer and type NU Wool Hydro Mulch, Jennison, MI.

L. Tackifier: Liquid concentrate diluted with water forming a transparent 3-dimensional film like crust permeable to water and air and containing no agents toxic to seed germination.

1. AVAILABLE MANUFACTURER AND TYPE:

2. FINN HYDROSTIK, FAIRFIELD, OH

3. POLYING DLR: CELITE INC., CLEVELAND, OH

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydro-seeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

A. Limit lawn subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

   a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

   b. Mix lime with dry soil before mixing fertilizer.

2. Spread lawn planting soil mix to a depth of 3 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least of 6 inches.

3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.

4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/4 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.

2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at the rate of 4-5 lb/1000 sq. ft. as indicated per specified seed mix.

C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh and 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into topsoil with suitable mechanical equipment.

3.6 TURF RENOVATION

A. Renovate existing lawn.

B. Renovate existing lawn damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.

C. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.

D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

E. Mow, dethatch, core aerate, and rake existing lawn.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new lawns.

K. Water newly planted areas and keep moist until new lawn is established.

3.7 MULCHING

A. Place straw mulch on seeded areas within twenty-four (24) hours after seeding.

B. Place straw mulch uniformly in a continuous blanket at a rate of 2-1/2 tons per acre or two (2) 50 lb. bales per 1,000 sq. ft. of area. A mechanical blower may be used for straw mulch application when acceptable to the Engineer.

C. Crimp straw into soil by use of a “crimper.” Two (2) passes in opposite direction required.

3.8 SLIT SEEDING (OPTIONAL METHOD)

A. Lawn to be professionally slit seeded by using equipment designed for this purpose. Recommended brands: Brillant, Jacobsen or Olathe.

3.9 HYDROSEEDING (OPTIONAL METHOD)

A. Use a hydromulcher (sprayer) and apply mixture(s) at the following rate. Mix in accordance with manufacturer’s recommendations.

B. Apply hydroseed slurry to indicated areas. Use tackifier only on erosion prone areas. Apply fertilizer with hydro mix.

Seed:	At specified seeding rates (300 pounds per acre)
Fertilizer:	400 pounds per acre
Tackifier:	60 gallons per acre
Wood Cellulose Fiber Mulch:	2000 pounds per acre

C. Care must be taken not to get hydroseed materials on buildings, walks, roadways, plant beds, etc.

3.9 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: 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 any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 4 by 4 inches.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION 329200

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
2. Section 31 3500 Slope Protection and Erosion Control

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 indentified 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

- Lesco - (248) 689-5005
- Rhino Seed & Supply - (800) 482-3130
- Michigan State Seed Solutions - (800) 647-8873
- 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 & 2 or 3 of the Perennial Ryegrass varieties. Blend shall be 80% Kentucky Bluegrass and 20% Perennial Ryegrass by weight. Premium Blends
2. General Seeding Areas: Blend shall be 50% Kentucky Bluegrass and 50% Perennial Ryegrass by weight for irrigated fields. A blend of tall fescue, bluegrass and ryegrass for non-irrigated fields.
3. Athletic Fields

Seed Varieties	Purity	Germination
• Adelphi Kentucky Bluegrass	95%	85%
• Indigo Kentucky Bluegrass	95%	85%
• Cannon Kentucky Bluegrass	95%	85%
• Geronimo Kentucky Bluegrass	95%	85%
• Midnight Kentucky Bluegrass	95%	85%
• SR2100 Kentucky Bluegrass	95%	85%
• Touchdown Kentucky Bluegrass	95%	85%
• Brightstar Perennial Ryegrass	95%	85%
• SR4010 Perennial Ryegrass	95%	85%
• Manhattan 3 Perennial Ryegrass	95%	85%

4. General Seeding Areas

Seed Variety	Purity	Germination
• Banff Kentucky Bluegrass	98%	85%
• Merit Kentucky Bluegrass	98%	85%
• Touchdown Kentucky Bluegrass	98%	85%
• Fiesta II Per. Rye	98%	90%
• Victory 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. natural organic material in a slowly available form, delivered in original unopened containers with the analysis, type and trade name attached to each container. The composition shall be:

1. Pre-plant Fertilizer composition shall be:
   5% Nitrogen (N)
   10% Phosphoric Acid (P_2O_5)
   5% Potash (K_2O)

2. Post Seeding Fertilizer composition shall be:
   12% Nitrogen (N)
   10% Phosphoric Acid (P_2O_5)
   10% Potash (K_2O)

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. Incorporate fertilizer into topsoil at a rate of 4 lbs./1000 S.F.

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 six (6) lbs./1000 sq. ft., using a cultipacker type seeder such as Brillion (or equal). Seed shall be uniformly spread over the previously fine graded and fertilized topsoil. **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 after 6 weeks 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 in 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 12-10-10 fertilizer when grass reaches height of one (1) inch. Rate of application shall be indicated by manufacturer.

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. The Owner will accept the lawns after three (3) cuttings if a uniform cover of grass is established.
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.
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

SECTION 33 4100 – 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, apply to work of this section. Where these specifications differ from the local or City's standard detail sheets, 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. Contractor shall note that new manholes and catch basins are not intended to be part of the project, but these specifications are provided in the event that any structures need replacement.

1. Storm Sewer Pipe
2. Perforated Underdrain Pipe
3. Castings
4. Manhole Sections and Steps
5. Catch Basin
6. Brick and Concrete Block Masonry

B. Related Sections may include, but not be limited to, the following:

1. Division 31 2000 Section "Earth Moving" for excavation and backfill.

1.3 QUALITY ASSURANCE

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

B. Compliance to City/Township Codes and all other agencies having jurisdiction shall govern material and installation procedures.

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.

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 STORM SEWER PIPE

A. General: Storm sewer pipe material shall be as indicated on the plans. If indicated on the plans, pipe materials shall conform to the following requirements.

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 Polyethelene Tubing (CPT)

1. Corrugated Polyethelene 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)

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.

2.2 PERFORATED UNDERDRAIN PIPE (PE or CPP)

A. General

1. Perforated underdrain pipe shall be perforated, corrugated polyethelene 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.

2.3 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. Where details or notes are not indicated, conform with the following requirements.

B. Manhole frames and covers: Material shall be MDOT Type A with perforated covers.

C. Catch basins and inlet castings: Catch basin and inlet castings shall be MDOT Type K when located in curbs and gutter, MDOT Type E in non-paved locations, and MDOT Type A when located in paved areas.

2.4 MANHOLE SECTIONS

A. Manhole walls

1. Standard manhole walls shall be Precast concrete units conforming to ASTM C 478, or be concrete block masonry.

B. Manhole bases: Manhole bases shall be precast concrete units of the dimensions indicated on the Drawings.

2.5 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.

2.6 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.

2.7 INLETS

A. Construct inlets of brick, block, masonry, or Precast units. Precast inlet units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

2.8 CLEANOUTS

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

2.9 MORTAR

A. Mortar for brick masonry or plastering manholes shall be made of one part Portland cement to two parts sand.

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 31 2000 Section “Earth Moving.”

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 31 Section “Earth Moving.”

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 33 4100

MANHOLES, CATCH BASINS AND SIMILAR STRUCTURES

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 04 0513 Mortar
3. Section 31 2000 Earthwork
4. Section 33 4600 Subdrainage System

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 catch basin units as indicated on Contract Documents and specified herein.

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM A48 – Standard Specification for Gray Iron Castings
   b. ASTM C139 – Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
   c. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar
   d. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections
2. Michigan Department of Transportation (MDOT)

1.4 SUBMITTALS

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

PART 2 – PRODUCTS

2.1 GENERAL

A. Concrete to be 3500 psi at 28 days.

B. Masonry sand for mortar shall conform to ASTM C144.

2.2 NYPLOPLAST STRUCTURE

A. Unit shall be 8" diameter drainage basin as manufactured by Nyloplast (Phone: 770-932-2443). Basin unit shall accommodate two outlet pipes.

B. Sump depth shall not exceed 24 inches.

C. Grate shall be 12" diameter cast iron.

2.3 MORTAR

A. Mortar for brick masonry or plastering manholes shall be made of one part Portland cement to two parts sand. Mortar shall conform to Specification Section 04 0513.

2.4 BRICK

A. Brick work shall meet the requirements of Medium Brick, ASTM C13

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation shall be of sufficient dimensions to provide ample space for sheathing and bracing is required and ample space for the workmen to perform their work in a satisfactory manner.

B. Refer to requirements of Section 31 2000 Earthwork.

C. All structure shall be backfilled and tamped in lifts not greater than 8". Contractor shall have on site al necessary power equipment to achieve 95% compaction.

3.2 BRICK AND BLOCK CONSTRUCTION

A. Laying of brick or block units shall be performed in such a manner that the courses will be true to line and the joints fully bonded.

1. In a structure of cylindrical design, the bricks shall be laid with the long dimension radially in the structure.
2. In a structure of rectangular design, the bricks shall be laid in alternate courses of headers and stretchers.
3. Structures
    a. Manholes shall be constructed of brick, concrete masonry units, precast reinforced concrete pipe, or monolithic concrete or as detailed.
    b. All manholes shall be constructed to conform to the details shown on drawings.
        i. Openings shall be provided in the manholes for future connections as shown on the plans or as ordered by the Engineer, of such size and at such elevation as directed and shall be considered incidental to the construction of the manhole.
        ii. All such openings shall be closed with concrete or vitrified clay stoppers or brick bulkheads, to prevent infiltration or leakage.
    c. The outside surface of all brick or masonry manholes on sanitary sewers shall be plastered one-half inch with mortar.
    d. Cast iron manhole steps shall be set in a full mortar bed in the masonry.
    e. Tops shall be tapered to receive the casting.

f. The manhole castings shall be set in a full mortar bed with the top at the required elevation and treated directly in line with the steps.
g. Manholes shall have flow lines shaped with concrete up to the spring line of the lines passing through.

4. Catch basins shall be constructed of brick, concrete masonry units, precast reinforced concrete pipe, or monolithic concrete, and shall conform to details shown on drawings.
   a. The inside surface of all brick or block catch basins shall be plastered one-half inch thick from the bottom to the corbel. The joints between the sections of precast pipe catch basins shall be plastered one-half inch thick and six inches wide, and no other plastering is required on such catch basins.
   b. Catch basins which have lines of 30" diameter or larger entering, or four (4) or more lines entering, shall have an inside diameter of five feet.
   c. Catch basins shall have a two (2) foot deep sump.
   d. Tops shall be tapered to receive the casting.
   e. Catch basins castings shall be set in a full mortar bed on top of the masonry. The castings shall be set with the top at the required elevation.

3.3 ADJUSTING EXISTING STRUCTURES

A. Whenever existing manholes, catch basins, valve chambers, or similar structures occur, the tops of such structures shall be adjusted or rebuilt so that the top of the casting will fit the crown and/or grade of the finished surface.

B. Raising castings shall be accomplished by use of precast adjusting rings and/or brick set in a full mortar bed with the casting re-set in accordance with preceding requirements for new construction.

C. Lowering castings shall be accomplished by removing a sufficient amount of the existing structure to allow for reconstruction of the taper section and re-setting the casting in accordance with the preceding requirements for new construction.

END OF SECTION 33 4413

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SUBDRAINAGE SYSTEMS – 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 2000 Earthwork
2. Section 31 2010 Earthwork (Turf)
3. Section 31 3219 Geotextile Fabric
4. Section 32 1813 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 ¾" 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 4600