



University of Minnesota

Physics and Nanotechnology Building

Twin Cities Campus, Minneapolis, MN

University Project Number 01-155-08-1718

PROJECT MANUAL

100% Construction Documents

Site, Architectural, Structural

Volume 1 of 3

December 16, 2011

Project Team:

Architectural Alliance

ZGF Architects

Research Facilities Design

Affiliated Engineers, Inc.

Meyer Borgman and Johnson, Inc.

Pierce Pini & Associates

Close Landscape Architecture

Elert and Associates

Lerch Bates, Inc.

DOCUMENT 00 0110.2

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13 5900 Shielded Rooms

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14 6300 Top Running Bridge Cranes

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31 1000 Site Clearing *(Not Included – Refer to Bid Package One)*

31 2200 Grading *(Not Included – Refer to Bid Package One)*

31 2310 Structural Excavation and Backfill *(Not Included – Refer to Bid Package One)*

31 2316 Excavation *(Not Included – Refer to Bid Package One)*

31 2316.13 Trenching *(Not Included – Refer to Bid Package One)*

31 2323 Fill *(Not Included – Refer to Bid Package One)*

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32 1123 Aggregate Base Courses

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33 4600 Subdrainage *(Not Included – Refer to Bid Package One)*

END OF VOLUME 1 TABLE OF CONTENTS

SECTION 01 1000.2

SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contract description.
- B. Contractor's use of site.
- C. Owner Occupancy.

1.2 CONTRACT DESCRIPTION

- A. Refer to bidding documents provided by Mortenson Construction.

1.3 WORK BY OTHERS

- A. Owner will enter into separate contracts for work that includes but is not limited to:
 - 1. Supply and Installation of Audio-Visual Systems equipment unless noted otherwise on drawing.
 - 2. Supply and Installation of wiring and devices for telecommunications MDF and IDF data rooms.
 - 3. Supply and Installation of Furnishings.
- B. Items noted NIC (Not in Contract), furniture and minor lab equipment will be furnished and installed by Owner..
- C. Remove and deliver to Owner the following items prior to start of work:
 - 1. Existing exterior light poles.
 - 2. Existing trees designated to be relocated.

1.4 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Construction Operations: Refer to limits of construction indicated on Drawings.
- B. Time Restrictions for Performing Exterior Work:
 - 1. Work shall normally be done during the period from 7:00 A.M. to 3:30 P.M., Monday through Friday.
 - 2. Necessary variations from normal work hours shall occur only with the express prior approval of the Owner.
- C. Utility Outages and Shutdown: Contractor shall plan and coordinate with the Owner any required disruptions in utilities, life safety systems, mechanical systems, building access, or other inhabited spaces a minimum of two weeks prior to requested shut down date.

1.5 OWNER OCCUPANCY

- A. The Owner will occupy the Mechanical Engineering during the installation of the chillers and cooling towers portion of this work.
- B. There must be no interruption and minimal disruption, by noise or debris, of Owner operations. Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner's operations.
- C. Maintenance of public access and circulation will require continuous coordination between Contractor and Owner.
- D. Schedule the Work to accommodate Owner occupancy.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 2000.2

PRICE AND PAYMENT PROCEDURES

PART ONE - GENERAL

1.1 SECTION INCLUDES

- A. Change procedures.
- B. Defect assessment.

1.2 CHANGE PROCEDURES

- A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. Project Directive: Architect/Engineer may issue Project Directives, signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.
- C. Proposal Requests: Architect/Engineer may issue Proposal Requests, which describe in detail, proposed changes to the Work. The Proposal Request may include supplementary or revised Drawings and specifications, and the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 21 days.
- D. Change Orders - Stipulated Sum/Price: Based on Proposal Request and Contractor's fixed price quotation.
- E. Change Orders - Time and Material: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Architect/Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
 - 1. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- F. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.
- G. Change Order Forms: AIA G701 Change Order.
- H. Execution of Change Orders: Contractor will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
- I. Correlation Of Contractor Submittals:

1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
3. Promptly enter changes in Project Record Documents.

1.3 DEFECT ASSESSMENT

- A. If, in the opinion of the Architect/Engineer it is not practical to remove and replace the Work, the Architect/Engineer will direct appropriate remedy or adjust payment.
- B. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.
- C. Authority of Architect/Engineer and Owner to assess defects and identify payment adjustments, is final.
- D. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
 1. Products wasted or disposed of in a manner that is not acceptable.
 2. Products determined as unacceptable before or after placement.
 3. Products not completely unloaded from transporting vehicle.
 4. Products placed beyond lines and levels of required Work.
 5. Products remaining on hand after completion of the Work.
 6. Loading, hauling, and disposing of rejected products.

PART TWO - PRODUCTS

Not Used.

PART THREE - EXECUTION

Not Used.

END OF SECTION

SECTION 01 2300

ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Alternates.

1.2 ALTERNATES

- A. Each Bid Alternate proposal shall be submitted as an individual change in the Proposal (not accumulative) and shall be proposed under the premise that no other Alternates have been accepted, except as otherwise noted. Each numbered Alternate as a whole, will be additive or deductive, as noted resulting in an addition to, or reduction of Project cost.
- B. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- C. The Owner reserves the right to reject all Alternates or accept any Alternates in any order or combination and to determine the low bidder on the basis of the sum of the Base Bid and the Alternates accepted. Alternates may be accepted at any time during the construction period with no increase in cost due to increase in cost of material or labor since acceptance of the Base Bid.
- D. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
- E. 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.
- F. Schedule of Alternates:
1. Alternate No. A-1: Delete 72 mobile workstations from lab spaces. Refer to attached plans for locations.
 2. Alternate No. A-2: Metal ceilings in First Floor conference rooms.
 - a. Provide metal pan ceilings in lieu of perforated gypsum panels.
 - b. Product to be Armstrong, MetalWorks, 5/16" Square Tegular, Microperforated, White, with BioAcoustic Infill Panel (Black Matte).
 3. Alternate No. A-3: Stainless steel cladding at entrances.
 - a. Provide stainless steel metal panel in lieu of composite aluminum panels at West and East entrances.
 - b. Product to be Contrarian Metal Resources Stainless Steel formed metal
Type: ATI 2003 at all exterior base panels 316 at interior base panels, upper wall panels and soffit panels
 - 1) Finish: Invarilux.

4. Alternate No. M-1:
 - a. Not Used.
5. Alternate No. M-2: Chiller Plant Additional Cooling Tower:
 - a. Install owner furnished cooling tower CT-2, associated piping and temperature controls and piping.
6. Alternate No. M-3: Chiller Plant Additional Chiller
 - a. Provide chiller CH-3, associated primary chilled and condenser water pumps, piping, and temperature controls.
7. Alternate No. CR-1: Clean Room Bay No. 1:
 - a. Provide full build out of Clean Bay No. 1 as shown on CRLF drawings.
 - b. Provide Air Handling Units AHU-C2 and AHU-C-3, associated temperature controls and piping for Clean Room Bay #1. Refer to mechanical drawings.
8. Alternate No. CR-2:
 - a. Not Used
9. Alternate No. CR-3: Ultrapure Water System
 - a. Increase the water quality of the clean-room ultrapure water system to reduce TOC and dissolved oxygen levels to below acceptable levels by the definition of E-1 quality water.
10. Alternate No. CR-4: Electrical Transformer
 - a. For cleanroom electrical distribution, provide alternate bid to provide equipment indicated on electrical plan cr-e5.01 and associated floor plans as transformer CRT3, switchboard CRDP3, and panelboards CR10 and CR11. Provide all conductors in interconnecting base bid conduits between CRDP3 and downstream panelboards and between CRDP3 and upstream electrical distribution indicated on plan cr-e5.01. Provide conductors indicated from CRDP3 indicated in the two (2) conduits which are empty under base bid and stubbed up in area adjacent to panels CR10 and CR11.

PART 2 - PRODUCTS

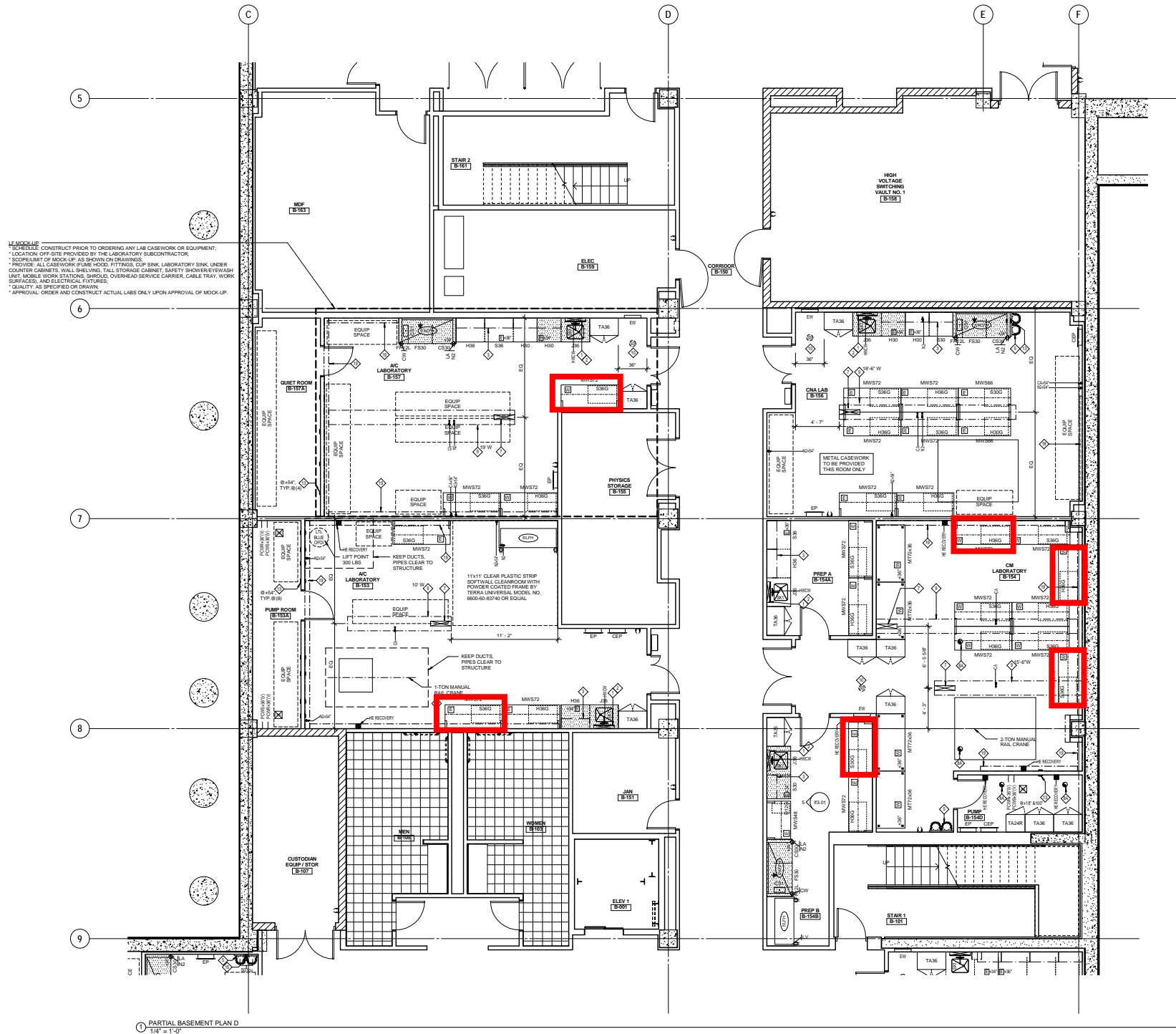
Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

ALTERNATE A-1: REDUCTION OF MOVABLE TABLES (MT), WORKSTATIONS (MWS) AND CABINETS AS NOTED ON THE FOLLOWING PAGES.



MOCK-UP
 * SCHEDULE CONSTRUCTION PRIOR TO ORDERING ANY LAB CASEWORK OR EQUIPMENT.
 * LOCATION, OFF-SITE PROVIDED BY THE LABORATORY SUBCONTRACTOR.
 * SCOPE/CONTENT OF MOCK-UP AS SHOWN IN DRAWINGS.
 * PROVIDE ALL CASEWORK (FLAME HOOD, FITTINGS, CUP BIN, LABORATORY SINK, UNDER COUNTER CABINETS, WALL SHELVING, TOOL STORAGE CABINET, SAFETY SHOWER/WEIGH UNIT, MOBILE WORK STATIONS, SHROUD, OVERHEAD SERVICE CARRIER, CABLE TRAY, WORK SURFACES, AND ELECTRICAL FITTINGS).
 * QUALITY AS SPECIFIED IN DRAWING.
 * APPROVAL: ORDER AND CONSTRUCT ACTUAL LABS ONLY UPON APPROVAL OF MOCK-UP.

1 PARTIAL BASEMENT PLAN D
 1/4" = 1'-0"

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I hereby certify that this plan or drawing was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

By	
Date	12/16/2011
Drawn	ADP
Checked	CHK
Date	11/27/11
Project	

Physics and Nanotechnology Building

UNIVERSITY OF MINNESOTA
 Driven to Discover
 LABORATORY FURNISHING
 BASEMENT PARTIAL PLAN

Not For Construction
 If2.00D

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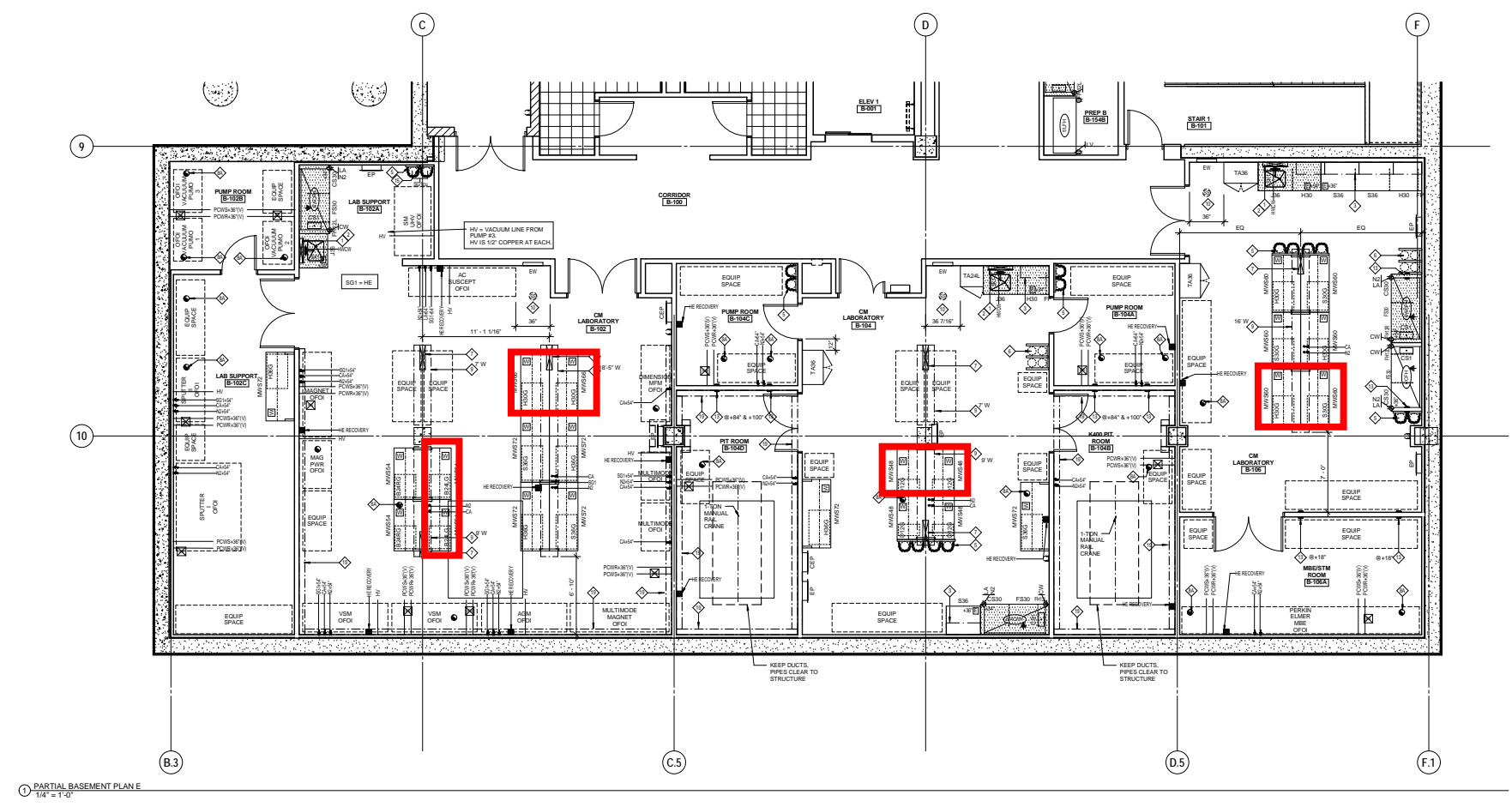
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Title	12/16/2011
Drawn for	12/16/2011
Checked	
Date	11/03/11
Project	

Physics and Nanotechnology Building



1 PARTIAL BASEMENT PLAN E
 1/4" = 1'-0"



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 If2.00E

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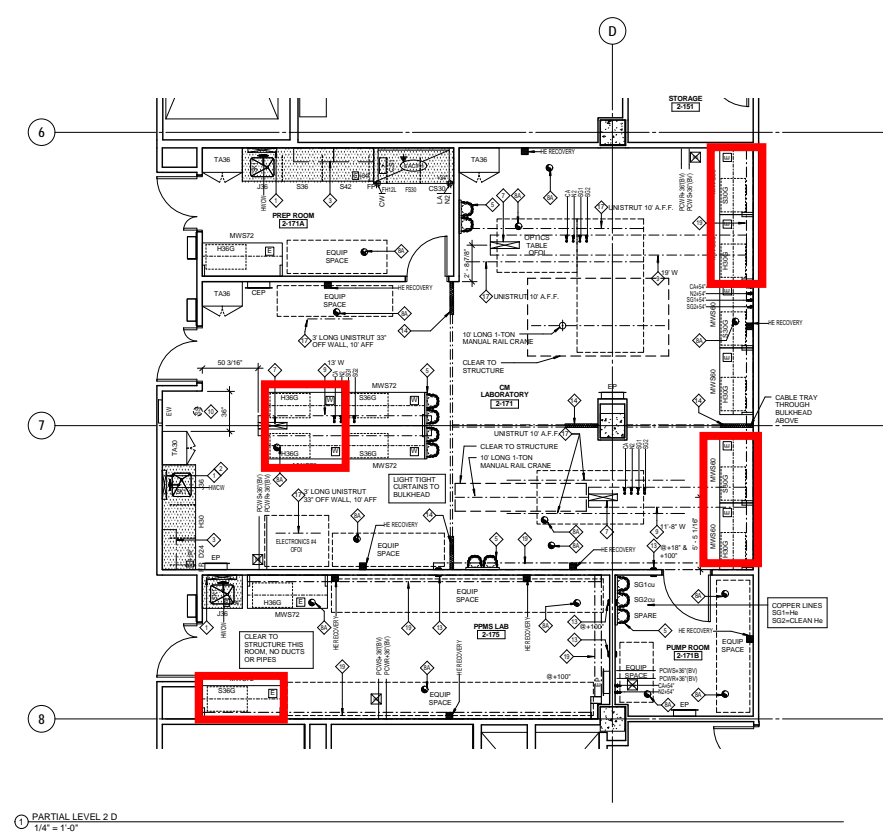
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Physics and Nanotechnology Building



① PARTIAL LEVEL 2 D
 1/4" = 1'-0"



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 If2.02D

A
B
C
D
E
F

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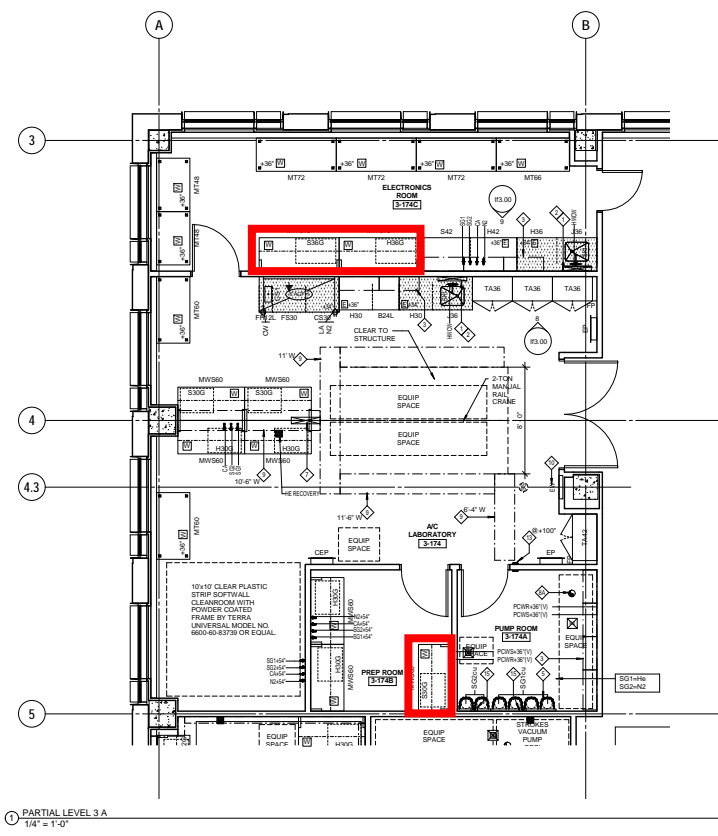
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Date	11/23/11
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Physics and Nanotechnology Building



1 PARTIAL LEVEL 3 A
 1/4" = 1'-0"



LABORATORY FURNISHING
 LEVEL 3 PARTIAL PLAN

Not For Construction
 If2.03A

A
B
C
D
E
F

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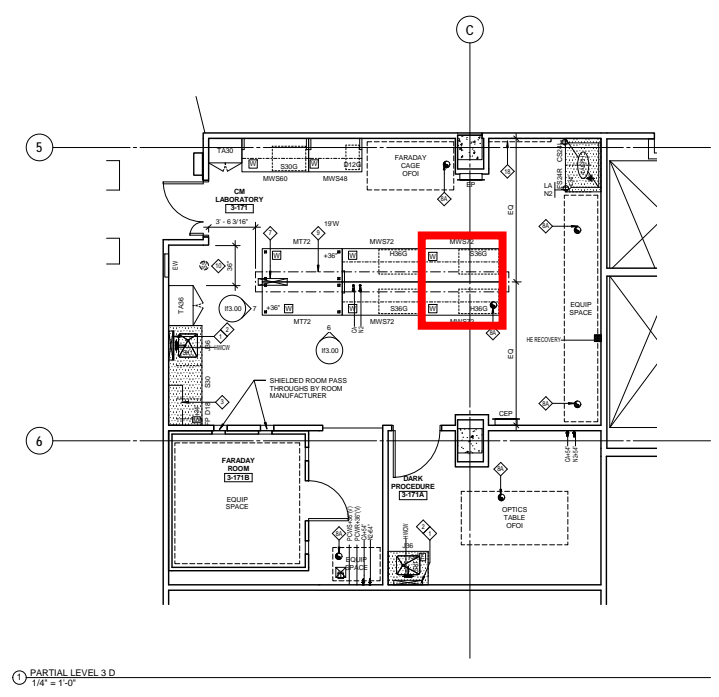
By _____
 Name _____
 Date 12/16/2011 Reg. No. _____

Issued for _____ Date 12/16/2011

Checked by _____
 Date 11/03/11

Project _____

Physics and
 Nanotechnology
 Building



1 PARTIAL LEVEL 3 D
 1/4" = 1'-0"



Not For Construction
 If2.03D

SECTION 01 3000

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Field engineering.
- C. Progress meetings.
- D. Pre-installation meetings.
- E. Cutting and patching.
- F. Special procedures for alterations to existing construction.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

- A. Employ Land Surveyor registered in State of Minnesota.

-
- B. Locate and protect survey control and reference points. Promptly notify Architect/Engineer of discrepancies discovered.
 - C. Control datum for survey is that established by Owner provided survey.
 - D. Verify set-backs and easements; confirm drawing dimensions and elevations.
 - E. Provide field engineering services. Establish structural grid, building elevations, lines, and levels, utilizing recognized engineering survey practices.
 - F. Submit copy of site drawing signed by Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.
 - G. Maintain complete and accurate log of control and survey work as Work progresses.
 - H. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
 - I. Promptly report to Architect/Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.
 - J. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

1.4 PROGRESS MEETINGS

- A. Contractor is to Schedule and administer meetings throughout progress of the Work at weekly intervals, unless otherwise agreed upon with the Owner.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Agenda should include the following:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems impeding planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to Work.
- D. Contractor shall record minutes and distribute electronic copies within five business days after meeting to participants with copies to those affected by decisions made.

1.5 PRE-INSTALLATION MEETINGS

- A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Provide notification to Owner and Architect seven calendar days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of installation, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute electronic copies within two days after meeting to participants, and those affected by decisions made.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate contractor.
- C. Execute cutting, fitting, and patching to complete Work, and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.
- E. Cut masonry and concrete materials using masonry saw or core drill.

- F. Restore Work with new products in accordance with requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with material in accordance with Section 07 8400 to full thickness of penetrated element.
- J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- K. Identify hazardous substances or conditions exposed during the Work to Architect/Engineer for decision or remedy.

3.2 SPECIAL PROCEDURES FOR ALTERATIONS TO EXISTING CONSTRUCTION

- A. Materials: As specified in product sections; match existing with new products for patching and extending work.
- B. Employ skilled and experienced installer to perform cutting and patching.
- C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.
- D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- E. Remove debris and abandoned items from area and from concealed spaces.
- F. Prepare surface and remove surface finishes to permit installation of new work and finishes.
- G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Protect ductwork and piping to prevent condensation in exposed areas.
- H. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to specified condition.
- I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.
- J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

- K. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Architect/Engineer for review. Where removal of partitions results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- L. Where change of plane of $\frac{1}{4}$ inch or more occurs, submit recommendation for providing smooth transition to Architect/Engineer for review.
- M. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing other imperfections.
- N. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

END OF SECTION

SECTION 01 3300.2

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Contractor's use of Architect's BIM files.
- C. Construction progress schedules.
- D. Proposed products list.
- E. Electronic submittals.
- F. Product data.
- G. Shop drawings.
- H. Samples.
- I. Design data.
- J. Test reports.
- K. Certificates.
- L. Manufacturer's instructions.
- M. Manufacturer's field reports.
- N. Construction photographs.
- O. Contractor's Review.
- P. Architect's Action
- Q. Electronic File Transfer Agreement

1.2 SUBMITTAL PROCEDURES

- A. Electronic drawings: Electronic files of the architectural drawings will be available from the Architect for the Contractor's convenience and use in preparing Shop Drawings related to this Project. Refer to Paragraph [1.3] for additional information.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

-
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities requiring sequential activity.
 2. 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 with other submittals.
 3. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Review time 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. Processing Time allowed shall be as described below.
1. Initial Review: Allow 14 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 that is being processed must be delayed for coordination.
 2. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
 3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 calendar days for initial review of each submittal.
 4. Concurrent Consultant Review: Allow 14 calendar days for initial review of each submittal. Structural, mechanical, plumbing and electrical submittals may be transmitted simultaneously to the Architect and to Architect's consultants for review. Submittal will be returned to the Architect before being returned to the Contractor.
- D. Identification: Place a permanent label or title block on each submittal for identification. For electronic document submittals, include an electronic cover sheet as the first page of the document. Provide the following information for each submittal:
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or electronic cover sheet or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label or electronic cover sheet for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor, Subcontractor and Supplier.
 - e. Name of manufacturer.
 - f. Submittal number including revision identifier. Submittal number format shall use the Specification Section number followed by a indicator representing the type of submittal and then the sequential number of the submittal (ex. 05 1200-SD-001)
 - g. Number and title of appropriate Specification Section.
 - h. Drawing number and detail references, as appropriate.
 - i. Location(s) where product is to be installed, as appropriate.
 - j. Other necessary identification.

-
- E. Deviations: Contractor shall specifically identify all deviations made from the Contract Documents on submittals.
 - F. Additional Copies: Unless additional copies are required for final submittal, or Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - G. Transmittal: Package each submittal individually and transmit using a transmittal form. Deliver submittals to Architect/Engineer at address listed on cover of Project Manual. For electronic submittals, the e-mail notification may serve as the transmittal. See Electronic Submittal Requirements.
 - H. Submittals shall be made by the prime General Contractor through the Architect only. Subcontractors and suppliers shall forward all their submittals to the General Contractor for submission the Architect. Submittals received from sources other than the General Contractor will be returned, without review.
 - I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label [or electronic cover sheet] or title block and clearly indicate extent of revision.
 - J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and authorities having jurisdiction if required, and others as necessary for performance of construction activities.
 - K. Use for Construction: Use only final submittals reviewed by Architect's and stamped with mark indicating "No Exception Taken" or "Note Comments" from Architect's action stamp.

1.3 CONTRACTOR'S USE OF ARCHITECT'S BIM FILES

- A. Requests for electronic drawing files must be made in writing using an "Architectural Alliance Electronic File Transfer Agreement", a copy of which is provided at the end of this section. Upon receipt of the signed release, electronic files will be forwarded to the contractor. In the event of a discrepancy between electronic files and hard-copy drawings and specifications, the signed or sealed hard-copy construction documents shall govern.
- B. Electronic drawing files for the work of other disciplines (structural, mechanical, electrical, civil, etc.) must be obtained directly from each engineer or consultant. It is Contractor's responsibility to verify the availability of electronic files for their use prior to submitting their bid.

1.4 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit progress schedule to Architect within 21 days after Notice to Proceed is issued by Owner.
- B. Submit revised Progress Schedules with the monthly Application for Payment.

-
- C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.
 - D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
 - E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.
 - F. Indicate estimated percentage of completion for each item of Work at each submission.
 - G. Submit separate schedule of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Architect/Engineer. Indicate decision dates for selection of finishes.
 - H. Indicate required delivery dates for Owner furnished products.
 - I. Revisions To Schedules:
 - 1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
 - 2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
 - 3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect

1.5 PROPOSED PRODUCTS LIST

- A. Within 21 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

PART 2 PRODUCTS

2.1 ELECTRONIC SUBMITTALS

- A. Utilizing electronic submittals is intended to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
- B. Whenever possible, submittals shall be transmitted to Architect in electronic (PDF) format via email or through the use of the Contractor's submittal exchange / file sharing (ftp) site. Electronic submittals may include shop drawings, product data, design data, construction photographs, and test reports.
 - 1. This electronic submittal process is not intended for the following:
 - a. Color samples, color charts, physical material samples.
 - b. Applications for Payment, Change Order forms, and other submittals not related to shop drawings and product data.

-
- C. Electronic Submittal Procedures:
1. Submittal Preparation - Contractor shall provide electronic submittals in a legible PDF format. Paper submittals that are electronically scanned and converted to PDF format are acceptable.
 2. Contractor shall review and insert electronic stamp, or shall manually stamp the submittal prior to scanning. Contractor's stamp shall certify that the submittal complies with the requirements of the Contract Documents, including verification of manufacturer/product, dimensions and coordination of information with other parts of the work.
 3. Individual pages of each submittal shall be combined into a single submittal document before transmitting to Architect. If submittal is transferred using a submittal exchange site, Contractor shall send an e-mail notice of the submittal to the Architect.
 4. Architect/Engineer review comments will be made available via email or on the submittal exchange site for downloading. Contractor will receive e-mail notice of completed review.
 5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
- D. Electronic Submittal File Names:
1. File names shall consist of the specification number and a sequential number representing the number of the submittal under that specification section (e.g. 06 4100-03 is the third submittal for section 06 4100). Resubmittals shall include a revision number after the sequential number (e.g., 06 4100-03-R1.pdf).
 2. Architect/Engineer will add an abbreviation to the end of the file name to indicate the file has been reviewed (e.g. 06 4100-03 - NC.pdf). The abbreviations indicate the action taken on the submittal and are as follows:
 - a. NE No Exceptions Taken
 - b. NC Note Comments
 - c. RR Revise and Resubmit
 - d. REJ Rejected
- E. Electronic Submittal Costs
1. Contractor shall include the cost of Electronic Submittal Procedures in their Contract Amount.
 2. Internet Service and Equipment Requirements:
 - a. Email address and Internet access at Contractor's main office.
 - b. Access to Adobe Acrobat (www.adobe.com) or similar PDF review software for applying electronic stamps and comments.

2.2 PRODUCT DATA

- A. Product Data: Submit to Architect/Engineer for review to check for conformance between information given and design concept expressed in Contract Documents. Submit product data before or concurrent with samples.
- B. Number of Copies: For hard copy submittals, submit number of copies Contractor requires for their distribution, plus two copies for the A/E. Provide electronic copy for the Architect/Engineer whenever possible.

-
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
 - D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 7000 - Execution and Closeout Requirements.

2.3 SHOP DRAWINGS

- A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance between information given and design concept expressed in Contract Documents.
- B. Shop drawings are comprised of technical drawings and data that have been specially prepared for this Project, including but not limited to the following items:
 - 1. Dimensions, including dimensions established by field measurement.
 - 2. Identification of products.
 - 3. Fabrication and installation drawings.
 - 4. Roughing-in and setting diagrams.
 - 5. Wiring diagrams, including field-installed wiring.
 - 6. Shopwork manufacturing instructions.
 - 7. Templates and patterns.
 - 8. Design and engineering calculations.
 - 9. Compliance with specified standards.
 - 10. Notation of coordination requirements.
 - 11. Relationship to adjoining construction clearly indicated.
 - 12. Seal and signature of professional engineer if specified.
 - 13. Schedules.
 - 14. NOTE: Standard product information prepared without specific reference to the Project is not considered to be a shop drawing. Shop drawing submittals that are direct copies of Contract Documents will not be approved.
- C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
 - 1. Include signed and sealed calculations to support design.
 - 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 - 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- D. Submit Shop Drawings or equivalent digital scans or prints formatted on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 40 inches (except for templates, patterns, and similar full-size drawings).
- E. For electronic submittals, submit one hard copy of all large format drawings (larger than 11 x 17) in addition to the electronic version.
- F. For submittals that are not suitable for electronic distribution, submit shop drawings in form of one reproducible hard copy and one additional hard copy. Submit two

additional copies of drawings for Civil, Structural, Mechanical and Electrical review of shop drawings, when applicable.

- G. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 7000 - Execution and Closeout Requirements.

2.4 SAMPLES

- A. Samples: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Samples For Selection as Specified in Product Sections:
1. Submit to Architect/Engineer 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.
 2. Submit samples of finishes from full range of manufacturers' standard colors, textures and patterns, unless otherwise specified in individual Specification Sections, for Architect/Engineer selection.
- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Submit number of samples specified in individual specification sections; Architect/Engineer will retain two samples.
- F. Reviewed samples that may be used in the Work, are indicated in individual specification sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification section.
- H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 7000 - Execution and Closeout Requirements.

2.5 DESIGN DATA

- A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents. Design Data submittals will not be reviewed or returned.

2.6 TEST REPORTS

-
- A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.
 - B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

2.7 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

2.8 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

2.9 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Architect/Engineer's benefit as contract administrator or for Owner.
- B. Submit report in electronic format within 5 days of observation to Architect/Engineer for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

2.10 CONSTRUCTION PHOTOGRAPHS

- A. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect/Engineer.
- B. Photographs: Medium resolution jpeg files.
- C. Take site photographs from differing directions and interior photographs indicating relative progress of the Work.
- D. Organize image files in folders and subfolders to identify name of Project, contract number, location/orientation of view, date of view, and photographer's numbered identification of exposure.

-
- E. Deliver image files on CD-ROM to Owner with project record documents. Catalog and index files in chronological sequence; include typed table of contents.

PART 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. 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 approval stamp before submitting to Architect. Submit drawings for Architect/Engineer's benefit as contract administrator or for Owner.
- B. 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. For electronic submittals, the Contractor's review stamp may be on a cover sheet included as the first page of the electronic document.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action on Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. No Exception Taken (NE): Submittal meets design intent.
 - 2. Note Comments (NC): Incorporate notations made on submittal.
 - 3. Revise and Resubmit (RR): Significant corrections or changes are required.
 - 4. Rejected (REJ): Submittal does not meet design intent.
- C. Informational Submittals: Architect will review each submittal and will not return it, unless it does not comply with requirements. Architect will forward each submittal to appropriate party for their information and records.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be processed or reviewed and may be discarded.

END OF SECTION

ELECTRONIC DOCUMENT RELEASE FORM

Project: _____

Re: **Hold Harmless Agreement for Access to Building Information Model**

(Contractor) has requested access to a copy of the Building Information Model (BIM) produced by Architectural Alliance and/or ARCHITECTURAL ALLIANCE Consultants (collectively "ARCHITECTURAL ALLIANCE") in conjunction with the above-mentioned project.

The Contractor acknowledges and agrees to the following:

1. ARCHITECTURAL ALLIANCE retains all right, title and interest to the BIM and the BIM remains the property and under the control of the ARCHITECTURAL ALLIANCE. Providing access to the BIM does not transfer copyright ownership or other rights to Contractor, and is instead a limited license to use in accordance with these and other conditions set by ARCHITECTURAL ALLIANCE. The Contract Documents do not require the Contractor to use the BIM to prepare drawings in electronic format for use during construction, or the use in any way of BIM or CAD systems. The Contractor is not permitted to make alterations to the BIM and/or the information contained therein.
2. The BIM and the information contained therein is provided in Revit Version 2012 format used by ARCHITECTURAL ALLIANCE. The **BIM** is provided without warranty or guaranty of compatibility with the Contractor's software or hardware systems. Further, the Contractor acknowledges data stored within the **BIM** can be altered, either intentionally or unintentionally, by transcription, machine error, environmental factors, duration of storage or operators, thus there is the potential for errors in the BIM and/or discrepancies between the BIM and the Contract Documents.
3. The **BIM**, and the information contained therein is provided for the Contractor's convenience only, is not a Contract Document and does not relieve the Contractor from the requirements of the Contract Documents. The information provided in the **BIM** may not reflect the Contract Documents in all areas and the Contractor will be required to verify where changes have occurred. Also, field verification of existing and as-built conditions are required as part of a submittal process.
4. The information provided in the **BIM** is only diagrammatic. Specifications require that the work and coordinated shop drawings reflect actual field verified conditions with actual equipment/duct sizes, utility locations, and related site/project conditions.
5. The Contractor accepts responsibility for ensuring all persons, including sub-contractors and suppliers, using the **BIM** comply with the requirements and limitations in using the information provided in this Release Form and Hold Harmless Agreement. Further, the use of these **BIM** is limited solely to the above-referenced project. Use of **BIM** on other projects or on other applications by the Contractor is expressly prohibited.
6. This Hold Harmless Agreement shall be attached to and transmitted with the BIM at all times so that all those that the Contractor allows to have access are bound by the terms of this Agreement.

By accepting the **BIM** and the above stipulations, the Contractor and its agents, employees, Subcontractors of any tier, material suppliers or any others that Contractor allows to access the BIM agrees to defend, indemnify and hold harmless the Client and ARCHITECTURAL ALLIANCE, their subconsultants, agents, and employees against all claims, liabilities, damages, losses, expenses and costs (including expert and attorney's fees) arising from, relating to or resulting from the use of the **BIM**.

Accepted for: Contractor) _____
(Signature of Authorized Agent of Contractor) _____
(Print Name of Authorized Agent of) _____
DATE _____

SECTION 01 4000.2

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quality control and control of installation.
- B. Tolerances
- C. References.
- D. Labeling.
- E. Mock-up requirements.
- F. Testing and inspection services.
- G. Manufacturers' field services.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

- A. For products or workmanship specified by association, trades, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- E. Neither contractual relationships, duties, responsibilities of parties in Contract, nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 LABELING

- A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.

1.6 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be comparison standard for remaining Work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect/Engineer.

1.7 TESTING AND INSPECTION SERVICES

- A. Owner will employ and pay for specified services of an independent firm to perform testing and inspection.
- B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Architect/Engineer, Owner, or Authority having jurisdiction.
- C. Testing, inspections and source quality control may occur on or off project site.
- D. Reports will be submitted by independent firm to Owner, Architect/Engineer and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify independent testing agency 48 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- G. Re-testing or re-inspection, required because of non-conformance to specified requirements, shall be performed by same independent firm on instructions by Architect/Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
- H. Limits On Testing Authority:
 - 1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency or laboratory may not approve or accept any portion of the Work.
 - 3. Agency or laboratory may not assume duties of Contractor.
 - 4. Agency or laboratory has no authority to stop the Work.

1.8 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

- D. Refer to Section 01 3300 - Submittal Procedures, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01 4000.2

Testing and Inspection Schedule

Project Name **Physics and Nanotechnology Building**
 UMN Project No. 01-155-08-1718

Location University of Minnesota, Twin Cities Campus, Minneapolis, MN

Permit No. _____

Special Structural Testing and Inspection

Specification Section Article	Description (2)	Type of Inspector (3)	Report Frequency	Assigned Firm (4)
03 1000 – 3.4	Concrete Formwork	ST-T	Periodic	
03 2000 – 3.3	Concrete Reinforcement	SI-T	Periodic	
03 3000 – 3.13	Concrete Placement	SI-T	Periodic	
03 4100 – 3.4	Precast Concrete Erection	SI-S, SI-T	Periodic	
31 6329 – 3.5	Drilled Piers	ST-T	Periodic	

Testing Schedule

	Description (2)	Type of Inspector (3)	Report Frequency	Assigned Firm (4)
31 2200 – 1.5	Soil Testing	TA	Periodic	
31 2310 – 3.17	Structural backfill testing	TA	Periodic	
31 2323 – 1.4	Soil Testing	TA	Periodic	
03 3000 – 3.13	Concrete Testing	TA	Periodic	

Notes: This schedule to be filled out and included in the project specification. Information unavailable at that time is to be filled out when applying for a building permit.

- (1) Permit No. to be provided by the Building Official.
- (2) Use descriptions per UBC Section 1701, as adopted by Minnesota State Building Code.
- (3) Special Inspector – Technical, Special Inspector – Structural.
- (4) Firm contracted to perform services.

ACKNOWLEDGMENTS

Each appropriate representative shall sign below.

Owner: _____ Firm: _____ Date: _____
Contractor: _____ Firm: _____ Date: _____
Architect: _____ Firm: _____ Date: _____
SER: Matthew E. Thomas Firm: Meyer Borgman Johnson Date: _____
SI-S: _____ Firm: _____ Date: _____
TA: _____ Firm: _____ Date: _____
SI-T: _____ Firm: _____ Date: _____
F: _____ Firm: _____ Date: _____
F: _____ Firm: _____ Date: _____

*The individual names of all prospective special inspectors and the work they intend to observe shall be identified. (Use reverse side of the form if necessary).

Legend: SER = Structural Engineer of Record SI-T = Special Inspector – Technical F = Fabricator
 TA = Testing Agency SI-S = Special Inspector – Structural

Accepted for the Building Department by: _____ Date: _____

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities:
 - 1. Temporary electricity.
 - 2. Temporary lighting for construction purposes.
 - 3. Temporary heating.
 - 4. Temporary cooling.
 - 5. Temporary ventilation.
 - 6. Telephone service.
 - 7. Temporary water service.
 - 8. Temporary sanitary facilities.

- B. Construction Facilities:
 - 1. Field offices and sheds.
 - 2. Vehicular access.
 - 3. Parking.
 - 4. Progress cleaning and waste removal.
 - 5. Traffic regulation.
 - 6. Fire prevention facilities.

- C. Temporary Controls:
 - 1. Barriers.
 - 2. Enclosures and fencing.
 - 3. Security.
 - 4. Water control.
 - 5. Dust control.
 - 6. Erosion and sediment control.
 - 7. Noise control.
 - 8. Rodent control.

- D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

- A. Provide power service as required for construction operation. Utilize Owner's existing power service, provide separate metering and reimburse Owner for cost of energy used.

- B. Provide temporary electric feeder from electrical service at location as directed by Owner. Do not disrupt Owner's use of service.

- C. Complement existing power service capacity and characteristics as required for construction operations.

-
- D. Provide power outlets, with branch wiring and distribution boxes as required for construction operations.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain lighting for construction operations.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.
- C. Maintain lighting and provide routine repairs.
- D. Permanent building lighting may not be utilized during construction, unless specifically approved by Owner.

1.4 TEMPORARY HEATING

- A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- B. Prior to operation of permanent equipment for temporary heating purposes, verify installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress. During the placing of interior wood and plastic doors, millwork, casework, composition flooring, acoustic tile, painting and decorating and similar finish materials, and continuing until the Owner assumes responsibility for heating the building, the minimum temperature shall be 65 degrees F. Refer to specific product sections for additional requirements.

1.5 TEMPORARY COOLING

- A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations
- B. Enclose building prior to activating temporary cooling in accordance with Enclosures article in this section.
- C. Prior to operation of permanent equipment for temporary cooling purposes, verify installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.6 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.7 TELEPHONE SERVICE

- A. Provide, maintain, and pay for telephone service to field at time of project mobilization.

1.8 TEMPORARY WATER SERVICE

- A. Provide suitable quality water service as needed to maintain specified conditions for construction operations.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.9 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

1.10 FIELD OFFICES AND SHEDS

- A. Provide Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment.
- B. Provide space for Project meetings, with table and chairs.
- C. When permanent facilities are enclosed with operable utilities, relocate offices and storage into building, with written agreement of Owner, and remove temporary buildings.
- D. Construction: Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors.
- E. Storage Areas And Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 6000 - Product Requirements.
- F. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.11 VEHICULAR ACCESS

- A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
- B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- C. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

- D. Provide unimpeded access for emergency vehicles.
- E. Provide and maintain access to fire hydrants free of obstructions.
- F. Provide means of removing mud from vehicle wheels before entering streets.

1.12 PARKING

- A. Arrange for parking permits with Owner, if required.
- B. Use of existing on-site streets and driveways used for construction traffic is permitted. Tracked vehicles not allowed on paved areas.
- C. Mud From Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site as needed and dispose off-site.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- F. Maintenance: Maintain signs and supports clean, repair deterioration and damage.
- G. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

1.14 TRAFFIC REGULATION

- A. Signs, Signals, And Devices:
 - 1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
 - 2. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
 - 3. Flagperson Equipment: As required by authority having jurisdiction.
- B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- C. Haul Routes:

1. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
- D. Traffic Signs And Signals:
 1. Provide signs at approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as required by Owner to direct construction and affected public traffic.
 2. Relocate as Work progresses, to maintain effective traffic control.
- E. Removal:
 1. Remove equipment and devices when no longer required.
 2. Repair damage caused by installation.
 3. Remove post settings.

1.15 FIRE PREVENTION FACILITIES

- A. Prohibit smoking in building during construction.
- B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.
- C. Standpipes: Install minimum one standpipe for use during construction before building reaches 40 feet in height.
- D. Portable Fire Extinguishers: NFPA 10; 10 pound capacity, 4A-60B; C UL rating.
 1. Provide one fire extinguisher at each stair on each floor of buildings under construction [and demolition].
 2. Provide minimum one fire extinguisher in every construction trailer and storage shed.
 3. Provide minimum one fire extinguisher on roof during roofing operations using heat producing equipment.

1.16 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way [and for public access to existing building].
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.17 ENCLOSURES AND FENCING

- A. Construction: Commercial grade chain link fence.
- B. Exterior Enclosures:

1. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- C. Interior Enclosures:
 1. Construction: Provide framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 2. Paint surfaces exposed to view from Owner occupied areas.

1.18 SECURITY

- A. Security Program:
 1. Protect Work from theft, vandalism, and unauthorized entry.
- B. Entry Control:
 1. Restrict entrance of persons and vehicles into Project.
 2. Allow entrance only to authorized persons with proper identification.

1.19 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water.

1.20 DUST CONTROL

- A. Execute Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.21 EROSION AND SEDIMENT CONTROL

- A. Per requirements specified by the Owner, plan and execute construction to control surface drainage from cuts and fills, and from borrow and waste disposal areas. Prevent erosion and sedimentation.
- B. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.22 RODENT CONTROL

- A. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.23 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 6000.2

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.

1.2 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide bonded and insured off-site storage and protection when site does not permit on-site storage or protection.

-
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
 - G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
 - H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
 - I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named, in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

- A. For a period of up to seven (7) days prior to bid date, Architect/Engineer will consider written requests from bidders, manufacturers, and suppliers for substitution of Products.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Submit all substitution requests on copies of the form provided at the end of this section. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension, which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

- F. Substitution Submittal Procedure:
1. Submit request for Substitution for consideration. Limit each request to one proposed Substitution.
 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
 3. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

(See Substitution Request Form on the following page.)

SUBSTITUTION REQUEST FORM

TO: *Architectural Alliance, 400 Clifton Ave. S., Minneapolis, MN 55403* **ATTN:** *Ellen Olson*
PROJECT: *University of Minnesota Physics and Nanotechnology Building*

SPECIFIED

ITEM: _____

Section Page Paragraph Description

The undersigned requests consideration of the following:

PROPOSED

SUBSTITUTION: _____

(Note: Only one substitution per form.)

Attached description includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents, which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on the other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by:

Signature

Firm

Address

Date

Telephone

Fax

For use by the design consultant:

Accepted Accepted as noted

Not Accepted Received too late

By

Title

Date

Remarks

Attachments: _____

SECTION 01 6900.2

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: This Section includes required recycling and recovery of the following waste materials and applies to listed waste materials produced during the Work:
 - 1. Land Clearing Debris: Solid waste generated solely from land clearing operations, such as stumps and trees.
 - 2. Concrete and Masonry: Clean concrete, brick, rock, and masonry.
 - 3. Metals: Metal scrap including iron, steel, copper, brass, and aluminum.
 - 4. Untreated Wood: Unpainted, untreated dimensional lumber, timber beams, engineered wood products, plywood, oriented strand board, Masonite, particleboard, wood shipping pallets, and crates.
 - 5. Gypsum Wallboard Scrap: Excess drywall construction materials including cuttings, other scrap, and excess materials.
 - 6. Paper and Cardboard: Discarded office refuse including unwanted files, correspondence, etc. Clean, corrugated cardboard used for packaging, etc.

- B. Non-Recyclable Waste: Collect and segregate non-recyclable waste for delivery to a permitted landfill site.
 - 1. Mixed Solid Waste: Solid waste commonly collected as a municipal service, exclusive of waste materials listed above.

- C. Related Sections:
 - 1. General and Supplementary Conditions of the Contract.
 - 2. Division 1 Specifications.
 - 3. Drawings and general provisions of each prime Contract.

1.2 DEFINITIONS

- A. Waste Materials are defined as large and small pieces of listed materials which are excess to contract requirements and generally include materials to be recycled and/or recovered from existing construction and items of trimmings, cuttings and damaged goods resulting from new installations, which can not be effectively used in the Work.

- B. Recycling is defined as the process of collecting and preparing recyclable materials and reusing them in their original form or in manufacturing processes that do not cause the destruction of recyclable materials in a manner that precludes further use.

- C. Recovery is defined as any process that reclaims materials, substances, energy, or other products contained within or derived from waste on-site. It includes waste-to-energy, composting, and other processes.

1.3 SUBMITTALS

- A. Construction Waste Management Plan: Prior to start of construction, submit a Construction Waste Management Plan for approval indicating how Contractor proposes to collect, segregate, recycle, and recover at least 75% of construction wastes and debris generated by the Work.
 - 1. Submit documentation indicating compliance with regulations specified under "Quality Assurance" article below. Include a list of recycling facilities to which indicated recyclable materials will be sent for recycling.
 - 2. Identify materials that are not recyclable, or otherwise recoverable, that must be disposed of in a landfill or other acceptable means under governing State of Minnesota and local regulations.
 - 3. List permitted landfills and/or other disposal means to be employed.
 - 4. Indicate instances where compliance with requirements of this specification does not appear to be possible and request resolution from the Owner.

- B. Delivery Receipts: Provide delivery receipts for waste materials salvaged and sent to permitted waste materials processors or recyclers within 48 hours of delivery.
 - 1. Indicate the location and name of firm accepting recyclable waste materials, types of materials, net weights of each type, date of delivery and value of materials.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable requirements of the State of Minnesota and applicable local ordinances and regulations concerning management of construction, demolition, land clearing, inert, and yard trash debris and subsequent modifications and amendments to same.

- B. Disposal Sites, Recyclers, and Waste Materials Processors: Use only facilities properly permitted by the State of Minnesota, and by local authorities where applicable.

- C. Pre-Construction Waste Management Conference: Prior to beginning work at the site, schedule and conduct a conference to review the Construction Waste Management Plan and discuss procedures, schedules and specific requirements for waste materials recycling and disposal. Discuss coordination and interface between Contractor and other construction activities. Identify and resolve problems of compliance with requirements. Record minutes of the meeting, identifying conclusions reached and matters requiring further resolution. Maintain waste management as an agenda item at future construction meetings.
 - 1. Attendees: Contractor and related Contractor personnel associated with work of this section, including personnel in charge of the waste management program; Engineer; Architect; material suppliers where appropriate; and such additional Owner personnel as Owner deems appropriate.
 - 2. Plan Revision: Make revisions to Construction Waste Management Plan agreed upon during the meeting and incorporate resolutions agreed to be made subsequent to the meeting. Submit revised plan to Architect for approval.

- D. Implementation:
 - 1. Designate an on-site party responsible for instructing workers and implementing Construction Waste Management Plan.

2. Distribute copies of Construction Waste Management Plan to job site foreman and each subcontractor. Include waste management and recycling in worker orientation.
3. Provide on-site instruction on appropriate separation, handling, recycling, and recovery methods to be used by all parties at the appropriate stages of the work at the site.
4. Include waste management and recycling discussion in pre-fabrication meetings with subcontractors and fabricators. Also include discussion of waste management and recycling in regular job meetings and job safety meetings conducted during the course of work at the site.

1.5 STORAGE AND HANDLING

- A. Site Storage: Remove materials for recycling and recovery from the work location to approved containers or storage area as required. Failure to remove waste materials will be considered cause for withholding payment and termination of Contract.
- B. Position containers for recyclable and recoverable waste materials at a designated location on the Project Site. If materials are sorted on site, provide separate collection containers or storage areas for not less than the following materials:
 1. Concrete and masonry.
 2. Metals.
 3. Untreated lumber.
 4. Gypsum wallboard scrap.
 5. Paper and cardboard.
- C. Change-out loaded containers for empty containers, as demand requires.
- D. Handling: Deposit indicated recyclable, and recoverable materials in storage areas or containers in a clean (no mud, adhesives, solvents, petroleum contamination), debris-free condition. Do not deposit contaminated materials into the containers until such time as such materials have been cleaned.
- E. If the contamination chemically combines with the material so that it cannot be cleaned, do not deposit into the recycle containers. In such case, request resolution by the Construction Quality Manager for disposal of the contaminated material. Directions from the Construction Quality Manager do not relieve the Contractor of responsibility for compliance with all legal and regulatory requirements for disposal, nor shall such directions cause a request for modification of the Contract.

1.6 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Transport recyclable and recoverable waste materials from the Work Area to containers and carefully deposit in the containers without excess noise and interference with other activities, to minimize noise and dust.
 1. Do not place recyclable waste materials on the ground adjacent to a container.
- B. Existing Conditions: Coordinate with "Instructions to Bidders" and "Supplementary Conditions".

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.1 WASTE MANAGEMENT

- A. General: Implement waste management procedures in accordance with approved Construction Waste Management Plan. Maintain procedure throughout the life of this Contract.
- B. Source Separation On- or Off-Site: Either separate, store, protect, and handle at the project site all identified recyclable and recoverable waste products to prevent contamination of materials and maximize recyclability and recoverability of materials. Or mix all identified recyclable and recoverable waste products for separation off-site.
- C. Arrange for the regular collection, transport from the site, and delivery to respective approved recycling centers of indicated recyclable waste materials. Maintain records accessible to the Architect for verification of construction waste materials recycling and recovery.
- D. Delivery Receipts: Arrange for timely pickups from the site or deliveries to approved recycling facilities of designated waste materials to keep construction site clear and prevent contamination of materials. Keep and maintain records of deliveries to recycling facilities and pickups of waste materials at the site by others as specified above.

3.2 RECYCLABLE WASTE MATERIALS HANDLING

- A. General: The following paragraphs supplement handling requirements for the materials identified for classification and recycling listed in Part 1 "Summary" article above.
- B. Landclearing Debris: Pile wood debris from landclearing in a clean storage area free from large amounts of dirt and other non-wood materials. Chip smaller size tree limbs on site and use as plant mulch. Cut larger tree limbs and trunks into 16 inch lengths and advertise as green firewood if hardwood or softwood suitable for burning. Transport other wood including tree roots to a County waste and recycling center.
- C. Concrete and Masonry: Free of metals, woods and other contaminants. If possible during demolition, crush existing concrete and concrete masonry units on-site into aggregate size. Store crushed material on-site in clean area to avoid contamination from other materials or building processes. Reuse on-site crushed material for fill, for stabilizing soils, or as base and sub base materials. If crushing on site is impractical, store material during demolition processes on site in clean, uncontaminated area. Transport concrete and masonry materials to a certified concrete recycler as needed.
- D. Metals: Cut items to lengths and sizes to fit within the container provided when necessary. Where there is sufficient quantity of a specific recyclable waste item (for example; salvaged metal roofing or duct work), make special arrangements for items

to be bundled, banded or tied, and stack in a designated location for a special pick-up. Coordinate special arrangements with the Construction Quality Manager.

- E. Untreated Wood: Salvaged wood materials to be free of metals, concrete, gypsum wallboard, insulation, and other contaminating materials. Stack dimensional wood into like piles. For example, store 2x4s with other 2x4s, and 2x6s with other 2x6s. Also, if quantity is sufficient, separate piles into lengths of 4-foot increments. Reuse lumber on site as studs, backing, blocking or other uses where appropriate. Stack non-dimensional wood in piles for possible reuse on-site or transport off-site. Depending on size of lumber, recycle or chip wood for plant mulch. If wood materials cannot be used on site, transport to a certified wood recycler or reuse center.
- F. Gypsum Wallboard Scrap: Separate gypsum wallboard from other wastes. Dispose of waste gypsum wallboard off-site at a gypsum reclamation or recycling facility, or on-site as a soil amendment.
- G. For on-site application as a soil amendment, incorporate waste gypsum wallboard in landscape areas under construction, at a rate of 50 pounds per 1000 square feet, or approximately one ton per acre.
 - 1. Material must be unpainted gypsum wallboard from new construction, ground to reduce material to a fine particle size (70% passing a 100 mesh screen), and must be fully incorporated into the soil surface.
- H. Paper and Cardboard: Classify and handle waste paper goods as follows:
 - 1. Bond Paper: General office quality paper used for specifications, correspondence, copiers, PC laser printers, and FAX machines. Collect in separate container at each workstation and deposit loose in appropriate recycle container as required.
 - 2. Newsprint: Newspapers and tabloid style advertising (slick finish magazines and advertising materials are not typically recyclable). Collect in single location and deposit as required in appropriate recycle container.
 - 3. Diazo Prints (drawings): Set up single location for collection. Roll together to minimize space. Deposit as required in appropriate recycle container.
 - 4. Cardboard and paper board cartons and boxes: Knock down, fold flat, and deposit in appropriate recycle container.
- I. Other Items: Where recyclability classification of any given waste material is unclear, verify with the Architect.

END OF SECTION

SECTION 01 7000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Starting of systems.
- D. Demonstration and instructions.
- E. Testing, adjusting and balancing.
- F. Protecting installed construction.
- G. Project record documents.
- H. Operation and maintenance data.
- I. Manual for materials and finishes.
- J. Manual for equipment and systems.
- K. Spare parts and maintenance products.
- L. Product warranties and product bonds.

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
- B. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities to Owner.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.

- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- D. Clean permanent filters of ventilating equipment and replace disposable filters when units have been operated during construction. In addition, clean ducts, blowers, and coils when units have been operated without filters during construction.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas and remove stains, spills, and foreign substances. Rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Owner two weeks days prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Final inspection.
- B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- C. Prepare and insert additional data in operations and maintenance manuals if need for additional data becomes apparent during instruction.
- D. Required instruction time for each item of equipment and system is specified in individual sections.

1.6 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.7 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish main floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, with D-style three ring white binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required, and Owners name.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.

1.9 MANUAL FOR MATERIALS AND FINISHES

- A. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- B. Submit two sets of revised final volumes in final form within 30 days after final inspection.
- C. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

- D. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- E. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- F. Additional Requirements: As specified in individual product specification sections.

1.10 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- B. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- C. Submit two sets of revised final volumes in final form within 30 days after final inspection.
- D. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Include servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Include control diagrams by controls manufacturer as installed.
- L. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

-
- N. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - O. Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.
 - P. Additional Requirements: As specified in individual product specification sections.
 - Q. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

1.12 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within fourteen days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Include Table of Contents and assemble in D-style three ring white binders with durable plastic covers.
- E. Submit two complete sets of warranties and bonds prior to final Application for Payment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 8113.2

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes general requirements and procedures for compliance with the State of Minnesota B3 Guidelines.
- B. Related Sections:
 - 1. Section 01 6900 – Construction Waste Management and Disposal.
 - 2. Divisions 01 through 33 Sections for B3 requirements specific to the Work of each of those Sections. These requirements may or may not include reference to B3.
 - a. Some B3 Guidelines are dependent on material selections and may not be specifically identified.
 - b. Compliance with B3 Guidelines may be used as one criterion to evaluate substitution requests.

1.2 REFERENCES

- A. The State of Minnesota Sustainable Building Guidelines—Buildings, Benchmarks, and Beyond (B3) <http://www.msbg.umn.edu/guidelines.html>
 - 1. Worksheet M-2: Construction Waste Recycling Economics.
http://www.msbg.umn.edu/downloads_v2_1/6Materials_App-M-3_V2-1.xls
 - 2. Worksheet M-3: Packaging Waste Recycling Economics.
http://www.msbg.umn.edu/downloads_v2_1/6Materials_App-M-4_V2-1.xls
 - 3. Form P-6: Materials and Waste Documentation.
http://www.msbg.umn.edu/p_6.html
 - 4. Design and Construction Phase Commissioning Plan Construction Air Quality Management Plan Template.
http://www.msbg.umn.edu/downloads_v2_1/2PerfMgt_App-P-4_V2-1.pdf
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - 2. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
 - 3. ASHRAE 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.
- C. ASTM International:
 - 1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
 - 2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 3. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

4. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
 5. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
 6. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- D. Carpet and Rug Institute:
1. CRI Green Label Testing Program.
 2. CRI Green Label Plus Testing Program.
- E. Forest Stewardship Council:
1. FSC Guidelines- Forest Stewardship Council Guidelines.
- F. Green Seal:
1. GC-03 - Anti-Corrosive Paints.
 2. GS-11 - Product Specific Environmental Requirements.
 3. GS-36 - Aerosol Adhesives
- G. Sheet Metal and Air Conditioning Contractors:
1. SMACNA IAQ - IAQ Guidelines for Occupied Buildings Under Construction.
- H. South Coast Air Quality Management District:
1. SCAQMD Rule 1113 - Architectural Coatings.
 2. SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- I. U.S. Environmental Protection Agency:
1. ENERGY STAR - ENERGY STAR Voluntary Labeling Program.
 2. EPA 832-R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
 3. EPA Baseline IAQ - Testing for Indoor Air Quality, Baseline IAQ, and Materials Section 01445.
 4. EPA Construction General Permit, 2003

1.3 DEFINITIONS

- A. Life Cycle Assessment (LCA): Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system or building component throughout its life cycle.
- B. B3: Buildings, Benchmarks, and Beyond.
- C. Remanufactured: Products or systems reassembled, after dismantling, cleaning, and repair, to prescribed standards and specifications using state-of-the-art equipment and components. During this process, new components may be installed which meet or exceed performance standards of the original product.
- D. Locally/ Regionally Manufactured: Materials manufactured regionally within a radius of 250 miles of project site to specified qualifications, or are manufactured within the State of Minnesota and contain products from state-sponsored, approved, or acknowledged recycling programs.

- E. Renewable Bio-Based Materials: Materials must be either: (a) residues from the processing of renewable, bio-based; OR (b) grown or harvested under a recognized sustainable management system.
- F. Salvage: Salvage is the act of removing something for reuse. Salvaged materials or products may be installed at the same site, in new construction on the same site, or installed at a different location.

1.4 SUBMITTALS

- A. General: Additional B3 submittal requirements are included in other sections of the Specifications.
- B. B3 submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated B3 requirements.
- C. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project. Include statement indicating total cost of mechanical and electrical components.
- D. B3 Action Plans: Provide the following preliminary submittals within 30 days the Notice of Award indicating how the following requirements will be met.
 - 1. Guideline M.2.A: List of proposed salvaged or reused materials.
 - a. Identify each material that will be salvaged or refurbished, its source, and cost.
 - 2. Guideline M.2.D: List of proposed materials with recycled content.
 - 3. Guideline M.2.E: List of proposed materials that have been extracted or harvested, processed and manufactured within 250 miles of project site or are within The State of Minnesota.
 - a. Identify each extracted, harvested or recovered material, which was processed or manufactured regionally, its source, and costs (material only).
 - 4. Guideline M.2.B: List of proposed bio-based raw materials.
 - 5. Guideline M.2.C: List of proposed materials with 50-100 year service life for the structure and envelope.
 - 6. Guideline M.2.F: List of proposed materials made from reusable, recyclable or biodegradable.
 - 7. Guideline M.3: Waste management plan complying with Division 1 Section - "Construction Waste Management and Disposal."
 - 8. Guideline M.3B: List of materials from construction and demolition diverted from landfill.
 - 9. Guideline M.3.E: List of reused or returned packing material.
 - 10. Guideline P.4: Construction indoor air quality management plan.
- E. B3 Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with B3 action plans for the following:
 - 1. Guideline M.2.A: Salvaged or refurbished materials.
 - 2. Guideline M2.D: Recycled content.

3. Guideline M2.E: Materials that have been extracted or harvested, processed and manufactured within 250 miles of project site or are within the State of Minnesota.
 4. Guideline M.3: Waste reduction progress reports complying with Division 1 Section - "Construction Waste Management and Disposal."
- F. B3 Documentation Submittals:
1. Guideline S.5.A: Product Data for interior and exterior lighting that eliminates light trespass from the site, improves night sky access and reduces development impact on nocturnal environments.
 2. Guideline S.8.A: Product Data for plumbing fixtures indicating water consumption.
 3. Guideline M.2.A: Receipts for salvaged or refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 4. Guideline M.2.D: Product Data and certification letter indicating percentages by weight content for products having recycled content. Include statement indicating costs for each product having recycled content.
 5. Guideline M.2.E: Product Data indicating location of material manufacturer for regionally manufactured materials.
 - a. Include statement indicating cost and distance from manufacturer to Project for each regionally manufactured material.
 - b. Include statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials.
 6. Guideline M.3: Comply with Division 01 Section "Construction Waste Management and Disposal."
 7. Guideline M.3.D: Product Data of diverted construction, demolition, and land clearing debris from landfill disposal.
 8. Guideline M.3.E: Product Data of reused or returned packing material.
 9. Guideline P.4: Construction indoor air quality management plan
 - a. Provide Narrative describing project's means of protecting stored absorptive materials from moisture damage.
 - b. Product Data for temporary filtration media.
 - c. Product Data for filtration media used during occupancy.
 - d. Product Data describing temporary construction ventilation.
 - e. Provide Narrative describing how HVAC systems will be protected during construction.
 - f. Provide Narrative describing project's offsite product preconditioning.
 - g. Provide Narrative describing project's process for identifying, removing and disposing of moisture damaged materials and replacement procedures.
 - h. Provide Narrative describing project's means to protect porous materials.
 - i. Provide Narrative describing the project's pre-occupancy flush-out procedures.
 10. Guideline I.2: Low-Emitting Materials
 - a. Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

11. Product Data for paints and coatings used on the used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24)
12. Product Data for carpet products indicating VOC content of each product used.
13. Product Data for composite wood and agrifiber products indicating that products contain no urea-formaldehyde resin.
14. Guideline I.5A: Product Data and Shop Drawings for sensors and control system used to monitor and control room temperature and humidity.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

- A. Guideline M.2.D: Provide building materials that contain, in aggregate, a minimum weighted average of 20% post-consumer recycled content material, OR, a minimum weighted average of 50% post-industrial recycled content material. These percentages will be increased over time to meet an eventual goal of zero waste.

2.2 REGIONAL MATERIALS

- A. Guideline M.2.E: Provide building materials (by cost) that are regionally extracted or harvested, processed and manufactured.

2.3 LOW-EMITTING MATERIALS

- A. Guideline I.2A: All newly installed interior materials shall be certified to comply with the most current Indoor Air Quality portion of California Section 01350 standard. Selection of a product listed in one of the approved databases below is sufficient to comply.
 1. California High Performance Schools (CHPS) Low Emitting Materials (LEM) Table
www.chps.net/dev/drupal/node/381
 2. Carpet And Rug Institute (CRI) Green Label Plus Certification (for adhesives)
www.carpet-rug.com/drill_down_2.cfm?page=8&sub=18&requesttimeout=350
 3. Carpet And Rug Institute (CRI) Green Label Plus Certification (for carpet)
www.carpet-rug.org/drill_down_2.cfm?page=8&sub=17&requesttimeout=350
 4. Scientific Certification Systems (SCS) Gold Indoor Advantage Certification
www.scscertified.com/manufacturing/manufacture_certclients.html
 5. Scientific Certification Systems (SCS) Floorscore™ Certification
<http://www.scscertified.com/gbc/floorscore.php>
 6. Greenguard Product Emission Standard For Children & Schools™
www.greenguard.org

- B. Guideline I.2B: All newly installed modular office furnishings shall comply with the most current version of the document "State of California Office Furniture Systems INDOOR AIR QUALITY-VOC EMISSIONS" Dated June 7, 2006. Contract Documents shall state that manufacturers must send a signed letter affirming that the product to be provided have been tested to comply with this standard within a year of delivery to the project.
- C. Comply with University of Minnesota, Facilities Management Appendix GG "Definition of Low VOC Content Levels" if more stringent than B3 Guidelines I.2A and B.

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. Guideline M.3: Comply with Division 1 Section - "Construction Waste Management and Disposal."

3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

- A. Guideline P.4: Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.
 - 1. If Owner authorizes the use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 01 5000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 - 2. Replace all air filters immediately prior to occupancy. Replacement air filters shall have a MERV 13 according to ASHRAE 52.2.
 - 3. Conduct a two-week building air flush-out after construction ends with new air filters and 100 percent outdoor air. Replace air filters after building air flush-out. Replacement air filters shall have a MERV 13 according to ASHRAE 52.2.
 - 4. Engage an independent testing and inspecting agency to conduct a baseline indoor air quality testing program according to EPA Protocol for Environmental Requirements, Baseline IAQ and Materials, for Research Triangle Park Campus, Section 01445.

END OF SECTION

SECTION 02 4119

SELECTIVE STRUCTURE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Selective demolition of building elements for chiller and cooling tower installation in the Mechanical Engineering Building.
- B. Related Sections:
 - 1. Section 01 6900 – Construction Waste Management and Disposal.
 - 2. Section 01 8113 – Sustainable Design Requirements.

1.2 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- C. Shop Drawings:
 - 1. Indicate demolition and removal sequence.
 - 2. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.
- C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

- A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection, and temporary mechanical shutdown
- B. Conform to University standards for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.

1.5 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.

- B. Convene minimum two weeks prior to commencing work of this section.

1.6 SCHEDULING

- A. Section 01 3000 - Administrative Requirements: Requirements for scheduling.
- B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation in adjoining spaces.
- C. Coordinate utility and building service interruptions with Owner.
 - 1. Do not disable or disrupt building fire or life safety systems without a minimum of two weeks prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.
 - 3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.7 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 SCOPE

- A. Remove portions of existing buildings to accommodate scope of work designated in the Documents.
- B. Remove the identified portions of the existing parking lot and structural slab required to place new chiller units in designated location in the basement level of Mechanical Engineering.
- C. Remove the identified portions of the existing cooling tower penthouse required to place new cooling tower units in designated location in the basement level of Mechanical Engineering.
- D. Remove other items indicated, for salvage, relocation, and recycling.
- E. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.2 PREPARATION

- A. Do not disable or disrupt building fire or life safety systems without a minimum of two weeks prior written notice to Owner.
- B. Notify affected utility companies before starting work and comply with their requirements.
- C. Mark location and termination of utilities.
- D. Erect, and maintain temporary barriers and security devices at locations agreed upon with the Owner, including warning signs and lights, and similar measures, for protection of the public, and existing improvements indicated to remain.
- E. Erect and maintain weatherproof closures for exterior openings.
- F. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- G. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- H. Provide appropriate temporary signage including signage for exit or building egress.
- I. Do not close or obstruct building egress path.

3.3 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.
- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.4 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.
- C. Do not close or obstruct roadways or sidewalks without permits.
- D. Cease operations immediately when structure appears to be in danger and notify Owner.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.
- G. Carefully remove building components indicated to be reused.
 - 1. Disassemble components as required to permit removal.
 - 2. Package small and loose parts to avoid loss.
 - 3. Mark components and packaged parts to permit reinstallation.
 - 4. Store components, protected from construction operations, until reinstalled.
- H. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site. Refer to Section 01 6900 for construction waste disposal.
- I. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- J. Remove temporary Work.

END OF SECTION

SECTION 03 1000.2

CONCRETE FORMWORK

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 formwork for cast-in-place concrete for the following:
1. Footings.
 2. Foundation walls.
 3. Grade Beams
 4. Slabs-on-grade.
 5. Suspended slabs.
 6. Concrete toppings.
 7. Building frame members.
 8. Building walls.
- B. Related Sections include the following:
1. Division 01 Section "Structural Testing and Special Inspections".
 2. Division 03 Section "Concrete Reinforcement".
 3. Division 03 Section "Cast-In-Place Concrete".
 4. Division 03 Section "Polished Concrete Finish System"
 5. Division 03 Section "Unbonded Post-Tensioned Concrete".
 6. Division 04 Section "Unit Masonry" for wedge-type inserts and dovetail slots.
 7. Division 05 for embedded items.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
1. ACI 117 – Specifications for Tolerance for Concrete Construction and Materials
 2. ACI 301 – Specification for Structural Concrete for Buildings.
 3. ACI 318 – Building Code Requirements for Structural Concrete.
 4. ACI 347 – Guide to Formwork for Concrete.
- B. American Plywood Association (APA) - Product Standard PS1, Construction and Industrial Plywood.
- C. American Society for Testing and Materials (ASTM).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Formwork Shop Drawings: Prepared by or under the supervision of a Specialty Structural Engineer detailing fabrication, assembly, and support of formwork.

1. Engineering Responsibility: Formwork, bracing, shoring, and reshoring design for construction loads are sole responsibility of Installer's Specialty Structural Engineer.
- C. Material Certificates: For each of the following, signed by manufacturers:
 1. Form materials and form-release agents.

1.5 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Shoring and Reshoring Drawings: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- C. Minutes of Pre-Installation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Specialty Structural Engineer Qualifications: Employ professional Engineer, registered in Minnesota, to perform design of formwork, shoring, and reshoring for construction loads. Sign and seal design Shop Drawings submitted to Owner for review.
- C. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 1. Build panel approximately 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.
 2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 1. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, forms and form removal limitations, shoring and reshoring procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In the following Part 2 articles where the titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces without telegraphing the formwork surface. Furnish in largest practicable sizes to minimize number of joints. Acceptable materials include the following:
 - 1. Plywood: Exterior-grade plywood panels, suitable for concrete forms, complying with APA PS 1, and as follows:
 - a. High-density or medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - 2. Metal; smooth faced.
 - 3. Other pre-approved, smooth faced panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Soil Retainers: Material to be rigid and non-degradable.
- G. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum; nonstaining; in longest practical lengths.
- H. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- I. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- J. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.
- B. Design, erect, shore, brace, and maintain formwork, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated.
 - 1. Edges of beams and slab edges that support brick shall be placed within 1/2" of the position indicated.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class C, 1/2 inch for rough-formed and smooth-formed finished surfaces. Provide Class C finish for typical cast-in-place concrete except as noted below.
 - 2. Class B, 1/4 inch for smooth-formed finished surfaces. Provide at cast-in-place structure above Clean room (between gridlines 3 to 9 and A to C) and columns.
- E. Construct forms tight enough to prevent loss of concrete mortar.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete, except as follows:
 - 1. Where concrete masonry walls abut concrete columns, do not chamfer corners of columns.
- J. Form openings, chases, offsets, recesses, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Fastening Devices for Other Work:
 - 1. Provide for installation of inserts, reglets, hangers, metal ties, anchor bolts and other fastening devices required for attachment of other work.

2. Properly locate fastening devices in cooperation with other trades and secure position before concrete is placed.
3. Where concrete surfaces are veneered with masonry, install two-piece stainless steel dovetail anchors with cast-in-place slot and adjustable triangular ties.
 - a. Install two continuous slots per face at each column face wider than 1'-4".
 - b. In concrete forms set vertically at 1'-4" on center.
4. Where masonry abuts concrete surface, install one continuous masonry anchor slot in concrete forms set vertically for each eight inches width of masonry, centered in masonry width.
- L. Install sleeves in concrete piers, columns, beams or joists only upon approval of the Architect.
- M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF VOID FORMS AND SOIL RETAINERS

- A. Placement:
 1. Place forms on smooth, level, firm, dry surface.
 2. Butt carton forms tightly end to end and side to side, seam side down.
 3. Place cover sheets on carton forms and staple.
- B. Moisture Protection:
 1. Do not let carton forms become wet.
 2. Remove and replace wet cartons.
- C. Place soil retainers at edge of grade beams.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved 75 its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

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- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
- B. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- C. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- D. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing agency to perform field tests and inspections and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties.
- B. Inspect formwork prior to concrete placement to verify resulting element width, depth and length correspond to those indicated on formwork installation drawings and Contract Documents.
- C. Where special formed surface finish requirements are required, verify forming materials comply with requirements.
- D. Adequacy of formwork, shoring, and reshoring to support vertical and lateral loads during construction is sole responsibility of Contractor.

END OF SECTION 03 1000.2

SECTION 03 2000.2

CONCRETE REINFORCEMENT

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. Reinforcing bars for cast-in-place concrete.
 2. Smooth bar dowels and diamond dowels and dowel baskets for concrete slab joints.
 3. Deformed bar anchors and headed shear connectors.
 4. Couplers for reinforcing bars.
 5. Welded wire fabric.
 6. Ties and supports for reinforcement.
- B. Related Sections:
1. Division 01 Section "Structural Testing and Special Inspections".
 2. Division 03 Section "Concrete Formwork".
 3. Division 03 Section "Cast-In-Place Concrete".
 4. Division 03 Section "Unbonded Post-Tensioned Concrete".

1.3 REFERENCES

- A. American Concrete Institute (ACI):
1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
 2. ACI 301 - Specification for Structural Concrete.
 3. ACI 315 - Standards on Details and Detailing of Concrete Reinforcement.
 4. ACI 318 - Building Code Requirements for Structural Concrete.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
1. AWS D1.1 - Structural Welding Code - Steel.
 2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI):
1. Manual of Standard Practice.
 2. Placing Reinforcing Bars.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Submit in accordance with ACI 315, "Standards on Details and Detailing of Concrete Reinforcement"

1. Provide necessary plan, elevation and section detail placing drawings that illustrate fabrication, bending, and placement of reinforcement.
2. Include bar sizes, lengths, material, and grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittal: For products having recycled content indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
- B. Welding certificates: signed by contractor certifying that welders comply with requirements of Article 1.5 – “Quality Assurance”.QUALITY ASSURANCE
- C. Fabricator Qualifications: A qualified fabricator utilizing experienced detailers who have successfully completed CRSI’s Reinforcing Bar Detailer Program.
- D. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code–Reinforcing Steel."
- F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 1. Retain subparagraph and associated subparagraphs below if warranted by complexity of design mixtures and quality control of concrete materials.
 2. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, and protection during concrete placement.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Deformed Bar Anchors (DBA): Standard fluxed ASTM A496 deformed bars prepared for stud welding.
- D. Headed Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

- E. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 775, epoxy coated.
- F. Stainless-Steel Reinforcing Bars: ASTM A 955, Grade 60, Type 304 , deformed.
- G. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 JOINT DOWELS

- A. Diamond Plate Dowels: Saw cut from ASTM A 36 hot rolled plate.
 - 1. Available Products:
 - a. Diamond Dowel™ by PNA, Inc.

2.3 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
 - 1. Available Products: 3M Scotchkote 213PC or liquid, two-part, epoxy repair coating or approved equal.
- B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. 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, or plastic according to CRSI's "Manual of Standard Practice," and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - 3. For stainless-steel reinforcement or where non-ferrous reinforcing is indicated, use plastic or non-ferrous bar supports.
- D. Supports for Rebar and PT Tendons in Post Tensioned Slabs: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Chairs are to be stable and resist tipping.
- E. Supports for Slabs-On-Grade with Steel Reinforcement: Use supports with sand plates or horizontal runners.
- F. Compression Couplers: Use only where explicitly referenced on Drawings.
- G. Tension Couplers: Use only where explicitly referenced on Drawings.
 - 1. Lenton Couplers by Erico.
 - 2. MRC 150 by Dayton Superior.
 - 3. No-Slip Coupler by Fox-Howlet.

2.4 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" and accepted shop drawings.
- B. Do not re-bend or straighten steel reinforcement except where specifically accepted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" and accepted shop drawings for placing reinforcement. Adjust reinforcing to avoid sleeves, blockouts and other voids in 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 by formwork, construction, or concrete placement operations. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Provide bar supports in sufficient number and heavy enough to carry steel they support. Place no bar more than 2 inches beyond last leg of continuous bar support. Do not use bar supports to support runways for concrete buggies, or similar loads.
 - 1. Maximum bolster spacing shall not exceed 36 inches for #4 support bar or 48 inches for #5 support bar.
 - 2. Bar supports on ground may be concrete block for slab depth of 7 inches or less and if positioned in staggered pattern. Provide bar chairs with sand feet where slab thickness exceeds 7 inches.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Steel reinforcement partially embedded in concrete shall not be field bent, except as indicated or permitted by Structural Engineer.
- G. For walls reinforced on both faces, provide spreader bars and chairs to surfaces of forms on each side at spacings not to exceed 8 feet in either direction. For walls with single layer of reinforcing, provide chairs each side at spacings not to exceed 8 feet in either direction.
- H. Install epoxy coated reinforcing bars using either epoxy or plastic coated tie wires. Place epoxy coated steel on epoxy coated bar supports. Patch cut ends and areas of damage.
- I. Install diamond plate dowels in concrete slab-on-grade joints where shown. Install diamond plate dowels per manufacturer's written instructions.

3.2 PROTECTION AND REPAIR

- A. Install additional bar supports at locations where reinforcement position is not maintained due to collapsed chairs or construction activity from time of original placement.
- B. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.3 FIELD QUALITY CONTROL

- A. Assign individual to monitor reinforcement position during concrete placement and reposition bars that are displaced due to construction activity.
- B. Testing and Inspecting: Owner will engage a qualified special inspector and material testing agency to perform field quality control inspections and testing in accordance with Division 01 Section "Structural Tests and Inspections" and as specified herein.
- C. Submit reports of inspections and material testing as soon as practical after they are made.
- D. Inspect reinforcement in all cast-in-place concrete footings, foundation frost walls, basement walls, and columns, excluding slabs on grade, footings without transverse reinforcement, and topping slabs. (Technical I).
- E. Inspect reinforcement in all cast-in-place concrete retaining walls and elevated structural slabs. (Structural I).
- F. Verify reinforcing bar grade, bar size and placement.
- G. Verify reinforcing bars are free of dirt, excessive rust and damage.
- H. Verify reinforcing bars are adequately tied, chaired and supported to prevent displacement during concrete placement. Verify proper clear distances between bars and to surfaces of concrete.
- I. Verify bar laps for proper length and stagger and bar bends for minimum diameter, slope and length.
- J. Verify mechanical splices are placed in accordance with Contract Documents and reviewed shop drawings.
- K. Verify epoxy coating is present at locations noted on the Contract Documents; include tie wires, chairs, bolsters, etc. Verify coating damage is repaired in accordance with the Contract Documents.
- L. Verify installation of anchor rods, embedded plates and angles are placed in accordance with the Contract Documents.
- M. Correct work that does not comply with specified requirements prior to scheduling concrete placement.

- N. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 03 2000.2

SECTION 03 3000.2

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, vapor retarder, concrete materials, mixture design, placement procedures, finishes and all related accessories, for the following:
1. Footings, Drilled piers, Foundation walls and piers, Grade beams.
 2. Superstructure walls, Slabs-on-grade, Columns, Elevated structure, Concrete toppings, Base slabs, Miscellaneous concrete items.
 3. Placement of embedded items provided by other trades.
 4. Concrete Floor Finish Types CS-2 and CS-3.
 5. Requirements for finished surfaces at Clean room cast-in-place concrete elements.
- B. Related Requirements:
1. Division 01 Section "Structural Tests and Special Inspections".
 2. Division 03 Section "Concrete Formwork".
 3. Division 03 Section "Concrete Reinforcement".
 4. Division 03 Section "Unbonded Post-Tensioned Concrete".
 5. Division 03 Section "Polished Concrete Finish System": Floor Finish CS-1.
 6. Division 04 Section "Unit Masonry" for wedge type inserts and dovetail slots.
 7. Division 05 Sections for items cast into concrete.
 8. Division 07 Sections for "Integrally Bonded Sheet Waterproofing".
 9. Division 31 Section "Structural Excavation".
 10. Division 32 Section "Concrete Paving".

1.3 REFERENCES

- A. American Concrete Institute (ACI):
1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
 2. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
 3. ACI 301 - Specifications for Structural Concrete for Buildings.
 4. ACI 302 – Guide for Concrete Floor and Slab Construction.
 5. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
 6. ACI 305 - Hot Weather Concreting.
 7. ACI 306 - Cold Weather Concreting.
 8. ACI 308 – Standard Practice for Curing Concrete.
 9. ACI 308.1 – Standard Specification for Curing Concrete.
 10. ACI 309 - Guide for Consolidation of Concrete.

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11. ACI 318 - Building Code Requirements for Structural Concrete.
- B. American Institute of Steel Construction (AISC): Code of Standard Practice for Buildings and Bridges.
 - C. American National Standards Institute (ANSI): NSF Standard 61.
 - D. American Society for Testing and Materials (ASTM).
 - E. Council of American Structural Engineers of Minnesota (CASE/MN): Guideline for Special Structural Inspection and Testing.
 - F. International Building Code (IBC).
 - G. Minnesota State Building Code (MSBC).
 - H. National Ready Mixed Concrete Association (NRMCA): Certification of Ready Mixed Concrete Production Facilities.

1.4 DEFINITIONS

- A. Floor Flatness Number, FF, measures floor curvature or flatness per ASTM E 1155.
- B. Floor Levelness Number, FL, measures floor inclination from a horizontal plane per ASTM E 1155.
 - 1. Floor Levelness, (FL), tolerances only apply to nonsloping slabs-on-grade and suspended slabs shored at time of testing. Floor Levelness tolerances shall not apply to slabs placed on unshored form surfaces, shored surfaces after removal of shores, or pitched slab surfaces per ACI 302.
- C. Overall FF/FL numbers represent minimum values acceptable for all combined local floor test sections representing the specified floor finish area per ACI 302.
- D. Local FF/FL test areas shall be defined as follows per ACI 302.
 - 1. Areas bounded by construction or control joints for slabs-on-grade.
 - 2. Areas bounded by columns and/or wall lines for elevated structural slabs.
 - 3. No less than one-half bay size.
- E. 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.

1.5 ACTION SUBMITTALS

- A. Concrete Mix Designs: Each concrete mix design submittal shall contain the following information:
 - 1. Mix Number (which will correspond to mix ticket on trucks delivered to site).
 - 2. Application for which concrete is designed (i.e. – footings, slabs, etc...)
 - 3. Applicable mix performance criteria including:
 - a. Final Design strength at 28 days.
 - b. Unit Weight.
 - c. Air Content.

- d. Slump (with water only and after addition of WRA and/or HRWRA).
 - e. For shrinkage compensating concrete, provide results of restrained prism expansion tests, ASTM C878, with mix design.
 4. Applicable mix ingredients including quantities, ASTM designations, and sources for:
 - a. Cementitious materials.
 - b. Aggregate source, geological type, size, and shape.
 - 1) Include total gradation for combined coarse and fine aggregates for mixes specified to contain Well Graded Aggregate.
 - 2) Included calculated Coarseness Factor and Workability Factor for mixes specifying limits on these values.
 - c. Water.
 - 1) Indicate amount of mixing water to be withheld for later addition at Project site.
 - d. Water cementitious materials ratio, w/cm.
 - e. Admixtures.
 - f. Fibers, color pigments, and other additions.
 5. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Proposed construction joint and saw-cut contraction joint locations for slabs-on-grade.

1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Product Data and Manufacturer's Instructions: For each type of product indicated.
1. Form-release agents
 2. Concrete Admixtures.
 3. Curing Materials.
 4. Joint Fillers.
 5. Waterstops.
 6. Floor and Slab Treatments.
 7. Bonding Agents.
 8. Adhesives.
 9. Repair Materials
- C. Preconstruction Material Test Reports:
1. Cementitious Materials.
 2. Compressive strength results of trial batches or historical test data, in accordance with ACI 318 Chapter 5, indicating following:
 - a. Specified compressive strength, f'_c .
 - b. Average compressive strength, f'_{cr} .
 - c. Number of consecutive tests.
 - d. Overall standard deviation.
 - e. Overall coefficient of variation.
 - f. Minimum moving average of three consecutive strength tests.
 3. Aggregate gradation, specific gravity, and absorption.
 4. Aggregate potential alkali-silica reactivity (ASR) for concrete in exterior, corrosive, or wet environments in accordance with ASTM C 289.
- D. Minutes of Pre-Installation conference.

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- E. Construction Test Reports:
 - 1. Concrete tests.
 - 2. Floor tolerance measurement.
 - 3. Industrial floor joint filler inspection.

 - F. Sustainable Design Submittals:
 - 1. Product Data: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating material weights and costs for each product having recycled content.
 - b. Design Mixtures: For each concrete mixture containing recycled pozzolanic or cementitious materials as a replacement for Portland cement and for equivalent concrete mixtures that do not contain Portland cement replacements.
 - 2. Product Data: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
 - a. Include statement indicating material weights, and costs for each product having regional content.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts:
 - 1. Curing and Sealing Compounds.
 - 2. Floor and Slab Treatments.

- B. Operation and Maintenance Data:
 - 1. Curing and Sealing Compounds.
 - 2. Floor and Slab Treatments.

- C. Bonds.

- D. Warranty Documentation:

- E. Record Documentation.

1.8 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 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

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- D. Source Limitations: Obtain materials from same source throughout Work.
 - E. Mockups: Construct mockups to demonstrate aesthetic effects and qualities of materials and execution.
 - F. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
 - G. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Administrative Requirements" and Division 01 Section "Quality Requirements".
 - 1. Review installer qualifications, methods, scheduling and testing procedures before work is started.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi rigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
 - 3. Authorized representatives of concrete supplier, industrial floor supplier and installer, floor finisher, testing and inspection agency, admixture supplier, steel fiber reinforcement supplier, Engineer, Owner and Construction Manager.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- B. Joint Filler, Joint Sealers and Curing Materials: Deliver in original factory packaging and unopened containers and protect from damage and contamination.

1.10 SITE CONDITIONS

- A. Provide total building enclosure including weather tight roof and walls before placing interior concrete slabs with exception of base slab for two-stage floor.
- B. During installation of interior slabs on grade, close openings in exterior walls and roofs enclosing areas.
- C. Provide minimum interior temperature 50 degrees F during installation and curing.
- D. Vent heaters or combustion equipment to outside.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CONCRETE MATERIALS

- A. Cementitious and Pozzolanic Materials: Use the following materials, of the same type, brand, and source for each required type of concrete and on which selection of concrete proportions was based:
1. Portland Cement: ASTM C 150, Type I.
 - a. Use white Portland cement where indicated for decorative concrete such as architectural wall panels, terrazzo surfaces, colored concrete, or other applications noted by Architect.
 - b. For exposed concrete, use same brand throughout.
 2. Fly Ash: ASTM C 618, Class C or F, and as specified herein.
 - a. Available Alkalis, as Na₂O equivalent: 1.5% maximum
 - b. Loss On Ignition (LOI): 1% maximum
 - c. Calcium Oxide Limit (CaO): 20% maximum
 3. Ground Granulated Blast-Furnace Slag (GGBFS): ASTM C 989, Grade 100 or 120.
 4. Microsilica: ASTM C 1240, amorphous silica.
 5. Blended Hydraulic Cement: ASTM C 595.
 - a. Available Products:
 - 1) Lafarge; Tercem 3000 – ternary blend of Portland cement, GGBFS, and microsilica.
 6. Replacement Ratio: Portland cement shall be replaced on an equal mass (not weight) basis. Material replacements shall be expressed as a percent, by mass, of the total cementitious materials content, with proportions selected for 28 day compressive strengths equal to those specified. The change in volume resulting from the substitutions shall be determined and an adjustment in both coarse and fine aggregate proportions shall be determined in order to ensure a unit volume.
 - a. Fly Ash replacement shall not exceed 30% for Class C, 20% for Class F, or as specified for a particular mix design.
 - b. GGBFS replacement shall not exceed 30% unless specified otherwise.
 - c. Microsilica replacement shall not exceed 10%.
 - d. Maximum cement replacement of concrete mixes containing pozzolan, and/or GGBFS combinations shall not exceed 50% unless specified otherwise.
- B. Normal-Weight Aggregates: ASTM C 33. Do not use aggregates containing soluble salts or other substances which can cause stains on exposed surfaces. Use aggregates from one source of supply corresponding to that on which selection of concrete proportions was based.

1. Coarse Aggregate: Minimum Class Designation:
 - a. Class 3S Typical
 - b. Class 4S Exterior horizontal concrete
 - 1) Maximum absorption 1.7%
 - c. Class 5S Exterior exposed architectural concrete
 - 1) Maximum absorption 1.7%
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - a. Refer to Concrete Floor Finishes for top broadcast aggregate requirements at Polished Concrete Floor System (CS-1).
3. Aggregate Gradation: Conform to ASTM C 33 and as specified herein.
 - a. Well Graded Aggregate: Provide in concrete mixes indicated with the combined coarse and fine aggregates meeting the following criteria:

Sieve Size	Top Size Aggregate		
	1 1/2"	1"	3/4"
	% Retained on Sieve		
1 1/2"	0% - 8%		
1"	8% - 18%	0% - 8%	
3/4"	8% - 18%	8% - 22%	0 - 6%
1/2"	8% - 18%	8% - 22%	6% - 22%
3/8"	8% - 18%	8% - 22%	6% - 22%
No. 4	8% - 18%	8% - 22%	6% - 22%
No. 8	8% - 18%	8% - 22%	6% - 22%
No. 16	8% - 18%	8% - 22%	6% - 22%
No. 30	8% - 18%	8% - 22%	6% - 22%
No. 50	3% - 12%	3% - 12%	3% - 12%
No. 100	0% - 8%	0% - 8%	0% - 8%
No. 200	0% - 5%	0% - 5%	0% - 5%

- b. At least 55% by weight shall be retained on or above the #4 sieve.
- c. A maximum of two non-adjacent sieves between 1 inch and No. 50 may fall outside the prescribed limits above with a minimum of 5% retained and a maximum of 22% retained on these nonconforming sieves.

C. Water: ASTM C 94 and potable.

2.3 ADMIXTURES

- A. General: 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 admixtures containing calcium chloride or thiocyanates.
- B. Air-Entraining Admixture (AEA): ASTM C 260.
- C. Water-Reducing Admixture (WRA): ASTM C 494, Type A.
- D. Mid-Range Water-Reducing Admixture (MRWRA): ASTM C 494, Type A.
- E. Polycarboxylate High-Range Water-Reducing Admixture (HRWRA): ASTM C 494, Type F.

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- F. Whelan Gum or Methylcellulose Viscosity Modifying Admixture (VMA):
 - G. Water-Reducing and Retarding Admixture: ASTM C 494, Type B and D.
 - H. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E.
 - I. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.
 - J. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 - K. Alkali-Silica Reactivity (ASR) Inhibitor: ANSI/NSF STD 61; lithium nitrate formulated admixture capable of mitigating ASR-induced expansion, cracking and popouts. Use when aggregate source is known to have potential alkali reactivity.
 - L. Integral Water Repellant Admixtures: Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction, and shall protect the concrete from deterioration due to harsh environmental conditions.
 - 1. Acceptable Manufacturer: Xypex Chemical Corporation
 - 2. Admixture shall be added to the concrete mix at the time of batching and at the manufacturer recommended dosage rates and according to the manufacturer's recommended procedures.
 - M. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures effectively containing chloride ions (more than 0.05 percent) are not permitted.

2.4 CONCRETE FLOOR FINISH SYSTEMS

- A. Polished Concrete Floor Finish System (CS-1): Refer to Section 03 3500 for finishing.
 - 1. System Description: Exposed concrete with aggregate broadcast and lightly troweled into top surface as concrete sets, in preparation for polishing after concrete has cured for a minimum of 28 days.
 - a. Aggregate: Crushed granite, of standard gradation and uniform coloration.
 - b. Aggregate Color: Black and dark grey.
 - c. Aggregate Size: No. 0-1.
- B. Concrete Floor Finish System (CS-2): Full Steel Trowel Finish with Hardener/Sealer plus Topcoat.
- C. Concrete Floor Finish System (CS-3): Full Steel Trowel Finish with Hardener / Sealer only.

2.5 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.6 MISCELLANEOUS EMBEDDED ITEMS

- A. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36 carbon steel.
 - 3. Washers: ASTM F 436 hardened carbon steel.
- B. Miscellaneous angles, channels, and plates: ASTM A 36.
- C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick (26-ga.), galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick (22-ga.), with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- E. Stair Nosings: Refer to Section 05 5000.

2.7 CURING, CLEANING, AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Water Cure:
 - 1. Waterproof paper.
 - 2. Reef Industries: Transguard Economy Grade. (ASTM C 171, 20-mils thick, polypropylene sheet with nonperforated white coating.)
 - 3. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
 - 4. Dayton Bag and Burlap: Burlene.
 - 5. Reef Industries: Transguard 4000; 42-mil thick, fiber mat with polyethylene sheet backing.
- C. Water: ASTM C 94 and potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, minimum 25 percent total solids.

- G. Clear, Non-yellowing, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, minimum 25 percent total solids.
- H. Penetrating Concrete Hardener/Sealer: Inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Basis of Design: Vexcon Certi-Shine Clear FSR.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- I. Concrete Hardener/Sealer Topcoat: Inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Basis of Design: Vexcon Certi-Shine Finish Coat Ultra.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- J. Equipment Control joint saw:
 - 1. Available Products:
 - a. Soff-Cut International; "Soff-Cut System," early-entry dry-cut saw with Skid Plate.
- K. Expansion Joint Material: ASTM D 1751, asphalt-saturated cellulosic fiber.
- L. Joint Backer Rod: Flexible, compressible, closed-cell polyethylene foam, not less than 10 psi compression deflection.
- M. Interior Joint Sealer: Mameco, Vulkem 45.
- N. Interior Bond Breaker Joint: 30 pound asphalt felt, without perforations.

2.8 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. 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 I and II, non-load bearing, IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- C. Under Slab Vapor Retarder: ASTM E1745, Class A.
 - 1. Manufacturers and Products:
 - a. Barrier Bac, Inc., VB350.
 - b. Raven Industries, Vapor Block 15.
 - c. Reef Industries, Inc., Vaporguard.
 - d. Stego Industries, Stego Wrap Vapor Barrier 15 mil.
 - 2. Accessories:
 - a. Seam tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4 inches wide.
 - b. Pipe boots: Constructed from vapor barrier membrane and seam tape.

2.9 CONCRETE MIXING

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, with exceptions specified herein, and ASTM C 1116 where fibers are used, 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.
- C. Admixtures: Use approved admixtures according to manufacturer's written instructions.
 - 1. Use chemical admixtures in concrete, as required, for placement, workability, durability, and controlled set time.
- D. Air Content: Do not allow air content of hard-troweled finished floors to exceed 3 percent.
- E. Concrete Slump Limits: Measured according to ASTM C 143 at point of placement.
 - 1. 4 inches without water reducing admixtures
 - 2. 5 inches after addition of WRA or MWRA.
 - 3. 7 inches after addition of HRWRA.
 - 4. A tolerance of up to one inch above indicated maximum will be allowed for one batch in any five consecutive batches tested.
 - 5. If the maximum water-cement ratio is not exceeded, concrete arriving at the jobsite within 60 minutes of the initial batching that has a slump less than the maximum allowed may have water added when accepted by the project inspector.
 - 6. Water reducing admixtures may be added to increase the slump when water cannot be added and additional slump is necessary for workability when accepted by the project inspector.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Drilled Piers: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	4000 psi
Maximum Cementitious Content	520 lb/cy
Maximum water/cementitious materials ratio, w/cm	0.50
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60% maximum 40% minimum
Top Size Aggregate	1-1/2 inch

- B. Foundation Walls, Grade Beams: Proportion normal-weight concrete mixture as follows:

Item	Requirements
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Compressive Strength at 28 days (min), f'_c	4000 psi
Maximum Cementitious Content	520 lb/cy
Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60% maximum 40% minimum
Top Size Aggregate	1-1/2 inch
Air Content (at point of placement) at un-insulated exterior foundation walls	5.5% (\pm 1.5%)

C. Superstructure Walls: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	Varies, see Drawings
Maximum Cementitious Content	540 lb/cy
Maximum water/cementitious materials ratio, w/cm	0.42
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60% maximum 40% minimum
Top Size Aggregate	3/4 inch
Air Content (at point of placement) at un-insulated exterior walls	5.5% (\pm 1.5%)

D. Columns: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	Varies, see Drawings
Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	80% maximum 20% minimum
Minimum Top Size Aggregate	3/4 inch

E. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	4000 psi
Maximum Cementitious Content	520 lbs/yd ³
Maximum water/cementitious materials ratio, w/cm	0.44
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F GGBFS	60% maximum 20% - 40% 0% - 20%
Minimum Top Size Aggregate	1-1/2 inch
Aggregate Gradation	Well Graded

Air Content (at point of placement) for slabs exposed to freezing and thawing	5.5% (\pm 1.5%)
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- F. Suspended Pan + Joist Slabs and Mild-Reinforced slabs: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	6000 psi
Maximum Cementitious Content	658 lbs/yd ³
Maximum water/cementitious materials ratio, w/cm	0.42
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F GGBFS	80% maximum 20% minimum 0% - 20%
Top Size Aggregate	3/4 inch
Aggregate Gradation	Well Graded

- G. Suspended Slabs-On-Metal Deck: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	4000 psi
Cementitious Materials Content	520 lbs/yd ³
Maximum water/cementitious materials ratio, w/cm	0.44
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F GGBFS	80% maximum 20% minimum 0% - 20%
Top Size Aggregate	3/4 inch
Aggregate Gradation	Well Graded
Air Content (at point of placement)	3% maximum

- H. Concrete Topping Slabs: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	4000 psi
Maximum Cementitious Content	564 lbs/yd ³
Maximum water/cementitious materials ratio, w/cm	0.42
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F GGBFS	80% maximum 20% minimum 0% - 20%
Minimum Top Size Aggregate	1/2 inch
Aggregate Gradation	Well Graded
Synthetic Fiber Blend	4 lbs/yd ³

- I. Miscellaneous Concrete Items: Concrete stair pan fill, curbs, housekeeping pads, etc. Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	3500 psi
Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60% maximum 40% minimum
Minimum Top Size Aggregate	1/2 inch

PART 3 EXECUTION

3.1 GENERAL

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.

3.2 PREPARATION

- A. Verify actual locations of existing structure, new work previously placed and other construction to which the new work must fit by accurate field measurements before submittal of related shop drawings or fabrication; show recorded measurements on shop drawings submitted for review. Coordinate fabrication schedule with construction progress to avoid delay of Work. Provide templates and dimensions to fabricator for accurate alignment with existing conditions. Show field conditions impacting the work on the shop drawings, prior to submittal.

3.3 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.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Engineer.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 2. Form joints with keyways and/or dowels as detailed. Embed keys at least 1-1/2 inches into concrete.
 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Contraction 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 where not specifically shown on Drawings:
1. Exterior Slabs:
 - a. Spacing shall not exceed 24 times slab thickness; 10 feet on center, maximum.
 - b. Short: long side ratio shall not be less than 3:4.
 2. Interior Slabs:
 - a. Spacing shall not exceed 36 times slab thickness; 17 feet on center, maximum.
 - b. Short: long side ratio not less than 2:3.
 3. 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.
 4. Sawed Joints: Form contraction joints with early-entry dry-cut 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.
 - a. Install cuts 0 to 2 hours after final finishing and prior to final set.
 - b. Install joint protector at saw-cut intersections prior to cross cut.
 5. Provide cleanly cut, straight joints in toppings over joints in base slab.
 6. Do not saw cut slabs on metal deck.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install expansion joint material at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend expansion joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width expansion joint material not less than 1 inch or more than 2 inches below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install expansion joint material in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Special Roughened Construction Joints (SRCJ): For construction joints noted in the drawings as special roughed construction joints, in addition to keying, hardened concrete joint face shall be cleaned totally free from laitance by bush hammering or sandblasting to provide rough, sound surface with roughness amplitude not less than 1/4 inch between projecting aggregate faces and recessed sand-cement matrix.
- F. Curbs: Provide control joints in poured in place concrete curbs 10 feet o.c. maximum spacings with expansion joints not over 40 feet o.c. Make control joints by cutting approximately 1/8 inch wide by one inch to 1-1/2 inch deep into exposed surfaces. Expansion joints shall be 1/2 inch wide with expansion joint material. At curbs adjacent to sidewalks, align joints in curb and sidewalk.

3.5 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding,

mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.6 INSTALLING UNDER SLAB VAPOR RETARDER

- A. Install according to membrane manufacturer's current published instructions and ASTM E1643.
- B. Install over level granular base and under reinforcing and slabs on grade.
- C. Lap over footings and seal to foundation walls.
- D. Overlap membrane joints minimum 6 inches and seal continuously with seam tape.
- E. Seal penetrations and pipes with pipe boot fashioned from membrane and sealed with seam tape.
- F. Repair damaged membrane with patches of membrane overlapping damage minimum 6 inches and sealing completely with seam tape.

3.7 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. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding water-reducing admixtures to mixture.
- C. Clean forms, reinforcing and accessories and lubricate forms prior to placing concrete.
- D. 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.
 - 4. Do not insert vibrators to bottom of slabs-on-grade with under floor vapor retarders to avoid damaging this membrane.
 - 5. Do not allow concrete to drop freely more than 4 feet.
 - 6. Use approved chutes equipped with suitable hoppers for placing where required.
 - 7. Place at rate that concrete is always plastic and flows readily into every space.

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8. Place beams, girders and haunches monolithically with floor system.
 9. Wait until concrete in columns and walls is no longer plastic before casting beams, girders or slabs supported by them.
- E. 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. Before concrete slabs on grade are placed, verify that granular base is level and compacted.
 2. Sprinkle base to eliminate suction of water from concrete.
 3. Allow no freestanding water.
 4. Place interior slabs only after permanent walls and roof enclose slab area.
 5. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 6. Maintain reinforcement in position on chairs during concrete placement.
 7. Do not insert vibrators to bottom of slabs-on-grade with under floor vapor retarders to avoid damaging this membrane.
 8. Screed slab surfaces with a straightedge and strike off to correct elevations.
 9. Slope surfaces uniformly to drains where required.
 10. 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.
- F. Concrete Finish Topping:
1. Prior to placing topping, remove laitance and loose particles of sand and dirt.
 2. Remove oil and grease spots by washing with 10 percent solution of muriatic acid or strong washing soda.
 3. After cleaning, hose down with pressure hose and keep base slab wet for at least 12 hours.
- G. Exercise care to prevent "over pouring" columns.
1. Remove column concrete which projects more than 1/2 inch into supported drop panel or beam.
 2. Remove column concrete which projects more than 0-inches into supported slabs without drop panels or beams.
 3. Avoid damaging reinforcing steel during removal of "over poured" concrete.
- H. Do not use concrete that has partially hardened or been contaminated by foreign materials, nor concrete that has been retempered or remixed after initial set.
- I. Before depositing new concrete on or against concrete that has set at construction joints, clean, wet and apply bonding agent to existing surfaces. Tighten forms prior to resuming pouring.
- J. Clean reinforcement projecting above or out of concrete immediately after completion of particular unit of pour.
- K. Do not place concrete under adverse weather conditions unless adequate protection is provided. Refer to ACI 301, for weather restrictions and placing temperatures.

3.8 COLD WEATHER CONCRETING

- A. 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, 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.
 4. Ensure minimum temperatures are maintained for the duration of the curing period in accordance with ACI 306.1.
 5. Concrete shall be allowed to dry for at least 12 hours before removing temperature protection for water cured or moisture retention cured concrete.

3.9 HOT WEATHER CONCRETING

- A. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. When high temperature, measured on jobsite at concrete placement area, is expected to rise above 90 deg F, 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. When temperature of steel reinforcement, embeds, subgrade, or forms is greater than 120 degrees F, fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
 3. Protect concrete from wind and direct sunlight to avoid rapid drying.
 4. Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40%. Apply according to manufacturer's written instructions immediately after placing and screeding.
 5. Apply moisture retaining covers or wet cure in accordance with concrete curing and protection methods as specified.

3.10 FINISHING FLOORS AND SLABS

- A. Finish bare concrete floors (adjacent to floors with other surfacing) so concrete surface is level with other finishes, unless otherwise noted.
- B. At areas to receive floor covering, grind joints smooth between slabs on grade and structural slabs and between existing and new surfaces to eliminate unevenness and to provide smooth, level surface across joints.
- C. Wetting the concrete surface during finishing operations is prohibited.
- D. Power floating with troweling machines equipped with normal trowel blades is prohibited.

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- E. Protect finished surfaces from damage. Keep free of abrasive materials.
 - F. In areas where water will be present (interior and exterior) place and finish slabs so areas will drain and water will not stand in puddles. Conform to slopes shown. At structural slabs, verify elevations of drains to insure drains will be at low points. Where elevations and slopes are not indicated, generally slope floors 1/8 inch per foot uniformly to drains, unless otherwise directed by Architect.
 - G. Finish slab to Floor Profile Number tolerances listed unless specifically noted otherwise on Drawings, according to ASTM E 1155 "Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers" for randomly trafficked floor surfaces.
 - H. General Finishing Requirements: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces as appropriate to attain floor slab finish specified.
 - I. CONC FIN-1: Float Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - J. CONC FIN-2: Light Trowel Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Restraighten surface if required following paste-generating float passes using 10-foot wide highway straightedge.
 - 3. Consolidate concrete surface, uniform in texture and appearance, with one to two passes using power trowel. Hand trowel areas inaccessible by power trowel.
 - K. CONC FIN-3: Medium Trowel Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Restraighten surface if required following paste-generating float passes using 10-foot wide highway straightedge. Apply in two directions at 45 degree angle to strip. Use supplementary material to fill low spots.
 - 3. Consolidate concrete surface, uniform in texture and appearance, with two to three passes using power trowel. Hand trowel areas inaccessible by power trowel.
 - L. CONC FIN-4: Hard Trowel Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Restraighten surface if required following paste-generating float passes using 10-foot wide highway straightedge. Apply in two directions at 45 degree angle to strip. Use supplementary material to fill low spots.
 - 3. Consolidate concrete surface, uniform in texture and appearance, with three or more passes using power trowel. Hand trowel areas inaccessible by power trowel.
 - M. CONC FIN-5: Trowel and Fine Broom Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Consolidate concrete surface, with one pass using a power trowel.
 - 3. Slightly scarify surface with soft bristled broom while concrete is still plastic.
 - N. CONC FIN-6: Scratch Finish.
 - 1. Follow General Finishing Requirements for initial procedures.

2. While still plastic, scarify slab surface to 1/8-inch amplitude with transverse scored texture by drawing broom, stiff brush, or rake across surface.
- O. CONC FIN-7: Light Broom Finish.
1. Surfaces of concrete mixes with silica fume and/or calcium nitrite must be kept moist (not wet) during finishing operations to promote proper texturing. Pressure foggers with a reach capable of covering the entire surface can aid finishing operations.
 2. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
 3. Scarify surface with a transverse scored texture using a stiff broom to provide a non-slip surface with a lighter texture. Coordinate required final finish with Architect before application.
 4. Finish Tolerance: Surface shall not vary by more than $\pm 1/2$ inch anywhere from elevation noted on Drawings.
 5. Finish all concrete slabs to proper elevations to insure that all surface moisture will drain freely, and that no puddles exist. Contractor must bear cost of any corrections to provide positive drainage and repairing poorly finished surface areas.
- P. CONC FIN-8: Heavy Broom Finish.
1. Surfaces of concrete mixes with silica fume and/or calcium nitrite must be kept moist (not wet) during finishing operations to promote proper texturing. Pressure foggers with a reach capable of covering the entire surface can aid finishing operations.
 2. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
 3. Scarify surface with a transverse scored texture using a stiff coarse bristled broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
 4. Finish Tolerance: Surface shall not vary by more than $\pm 1/2$ inch anywhere from elevation noted on Drawings.
 5. Finish all concrete slabs to proper elevations to insure that all surface moisture will drain freely, and that no puddles exist. Contractor must bear cost of any corrections to provide positive drainage and repairing poorly finished surface areas.
- Q. Coordinate final slab texture requirements with Division 9 flooring installer for proper adhesion of final flooring materials.
- R. Coordinate final slab requirements with Division 3 polished concrete finishing system for proper preparation for polishing.
- S. Summary Slab Finish Schedule:

SLAB USE	SLAB FINISH	OVERALL F_f/F_L	LOCAL F_f/F_L
Fluid-applied or sheet waterproofing; built-up or membrane;	CONC FIN-1 Float Finish	F_f18/F_L15	F_f15/F_L10
Loading dock vehicle areas and carpeted	CONC FIN-2 Light Trowel	F_f25/F_L20	F_f17/F_L15

SLAB USE	SLAB FINISH	OVERALL F_r/F_L	LOCAL F_r/F_L
areas;	Finish		
Thin set resilient flooring; paint; or other thin film-finish coating system	CONC FIN-3 Medium Trowel Finish	F_r35/F_L25	F_r25/F_L17
Exposed to view with light foot traffic (includes laboratory spaces) or to receive Penetrating Liquid Densifier and Sealer	CONC FIN-4 Hard Trowel Finish	F_r35/F_L25	F_r25/F_L17
Thin set ceramic or quarry tile	CONC FIN-5 / 7 Trowel and Fine Broom Finish	F_r35/F_L25	F_r25/F_L17
Exposed to view polished concrete floors	CONC FIN-4 Hard Trowel Finish	F_r50/F_L35	F_r44/F_L25
Below bonded concrete floor topping or mortar setting beds for tile, , and other bonded applied cementitious finish flooring material	CONC FIN-6 Scratch Finish	F_r18/F_L15	F_r15/F_L10
Slab surfaces to be covered with traffic coating and interior exposed concrete stair treads, landings and ramps	CONC FIN-7 Light Broom Finish	F_r35/F_L25	F_r25/F_L17
Exterior concrete platforms, steps, ramps and sidewalks and where noted	CONC FIN-8 Medium Broom Finish		

- T. Measurement of Floor Tolerance:
1. Frequency: Conduct floor tolerance or measurements within 72 hours of final finishing operations and prior to removal of forms on elevated slabs for each slab placement.
 2. Floor slab tolerances provided for localized areas shall apply to sections maximum one bay in length and minimum one-half bay.
 3. Conduct measurement of floor tolerance for other slab areas utilizing Dip Stick Floor Profiler.

3.11 FINISHING FORMED SURFACES

- 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. May be used for formed concrete surfaces below grade that are not exposed to view on interior side, unless indicated otherwise.
- B. CONC FIN-20: Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. For use at typical cast-in-place concrete, except as noted below.
- C. CONC FIN-21: Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with carborundum brick or another abrasive to produce a smooth, uniform surface texture.
 1. For use at Clean room on all cast-in-place concrete elements to be covered with an epoxy coating and where indicated on Drawings,
- D. 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.

3.12 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. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. 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.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces. Before final troweling of exposed treads and landings, apply dampened non-slip shake at a minimum rate of ¼ pound over square foot of surface.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Concrete shall be maintained above 50-degrees F and in a moist condition for at least the first seven days after placement. Provide curing and protection immediately after placement in accordance with ACI 301 using materials as specified herein.

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- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40% before and during finishing operations as measured at the Project site. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, 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.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Wet Curing: Keep surfaces continuously wet for not less than three 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.
 - d. Protect surface from rapid loss of moisture upon termination of wet curing by covering with moisture-retaining covers for the remainder of the curing period.
 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. 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.
 - a. After curing period has elapsed, completely remove curing compound without damaging concrete surfaces using concrete floor cleaner and stripper recommended by curing compound manufacturer.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- F. Curing Compounds or Curing and Sealing Compounds shall not be used on concrete surfaces to receive adhered coverings or Penetrating Liquid Densifier and Sealer without prior manufacturer certification that it will not interfere with bonding of floor covering and warranties of flooring installer are validated.
- G. Moisture Condition of Slabs – Following placement of concrete and climatization of building, check to see that any specified tests for moisture emission have been made and a written report submitted prior to floor covering or coating installation.

3.14 PENETRATING HARDENER/SEALER AND TOPCOAT

- A. Provide penetrating concrete hardener/sealer on concrete floors where scheduled to remain exposed to view (Refer to CS-2 and CS-3 notations on Material Finish Schedule).
 - 1. Provide topcoat on concrete floors where scheduled to remain exposed to view (Refer to CS-2 notation on Material Finish Schedule).
- B. Penetrating Concrete Hardener/Sealer: Prepare, apply, and finish sealer and topcoat in strict accordance with manufacturer's written instructions at concrete floors scheduled to receive the finish system.
 - 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 28 days old unless treatment also functions as a curing aid.
 - 3. Apply according to manufacturer's installation recommendations. Apply a second coat in a similar manner if surface is rough or porous.
 - 4. At floors designated in room finish schedule, apply according to manufacturer's installation recommendations.
- C. Concrete Hardener/Sealer Topcoat: Prepare and apply topcoat in strict accordance with manufacturer's written instructions.
- D. Protect finish surface during remainder of construction. Repair immediately any staining of finish concrete surfaces by methods recommended by manufacturer.
- E. Dry buff finish floor surfaces per manufacturer's written instructions to achieve final gloss appearance of liquid densifier and sealer just prior to substantial completion after majority of heavy construction and wet work activities have been completed.

3.15 JOINT FILLING

- A. Arrange for on-site supervision by manufacturer's personnel.
- B. Coordinate with Owner that adequate protection or spatial separation is provided to ensure there is not contamination of Owner's stored product during joint filling.
- C. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has cured for 30 to 90 days and space has assumed its normal operating temperature. Do not fill joints until construction traffic has permanently ceased.
- D. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry. Clean inside wall of joints to bare concrete.
- E. Mix filler thoroughly with power equipment according to manufacturer's published instructions.
- F. 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.
- G. Protect joint completely from traffic for 8 hours and from vehicular traffic for 24 hours.
- H. Touch Up:

1. Within one year after Substantial Completion, touch up joints with additional material and correct for normal joint movement according to manufacturer's published directions.
2. Coordinate schedule for joint touch up with Owner.
3. Touch up joints during Owner's non-working hours as required by Owner.
4. Coordinate with Owner and Architect to ensure there is no contamination of Owner's stored product.

3.16 JOINT SEALING

- A. When concrete has cured 30 to 90 days, and space has assumed its normal operating temperature, rake out loose debris and clean joint with compressed air.
- B. Install backer rod and sealant according to manufacturer's published recommendations.
- C. Protect joint completely from traffic for 24 hours.

3.17 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas only after approval by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval and in accordance with ACI 301. Repair methods for defects affecting the concrete's structural performance shall be closely coordinated between Contractor and Engineer.
- B. Patching Mortar: Submit proposed patching materials for Architect's review and approval.
- 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

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- wide or that penetrate to reinforcement or completely through unreinforced 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.

3.18 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 01Section Structural Tests and Special Inspections”, and with IBC 2006 Chapter 17 as adopted by the 2007 MSBC, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Contractor will cooperate with and assist testing agency in obtaining representative concrete samples as concrete is placed for determining slump and air entrainment and casting test cylinders.
1. Provide suitable space on site for storage for field condition test cylinders.
 2. If testing agency is not available, cast compression test cylinders as concrete is placed, determine and record slump of concrete, determine and record air

content of concrete and submit cylinders and information to the testing agency.

- C. Inspections:
1. Verification of use of required design mixture.
 2. Concrete placement, including conveying and depositing.
 3. Curing procedures and maintenance of curing temperature.
 4. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests (Technical 1): Testing of composite samples of fresh concrete obtained according to ASTM C 172 - Practice for Sampling Freshly Mixed Concrete, ASTM C 31 - Practice for Making and Curing Concrete Test Specimens in the Field, and ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens. Evaluation and acceptance of concrete shall be in accordance with ACI 318 and according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture where less than 50 yd³ is placed, plus one additional set for each additional 100 yd³ or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; one test at point of discharge for each composite sample.
 - a. Perform additional tests when concrete consistency appears to change.
 - b. For industrial slabs, slump each truck until slump stabilization is reached then decrease slump frequency to one test per 25 cubic yards.
 3. Air Content: When air content is specified, perform test in accordance with ASTM C 231, pressure method, for normal-weight concrete and ASTM C 173, volumetric method, for structural lightweight concrete.
 - a. Where placement is by pump, air content shall be measured at location of placement.
 - b. For concrete exposed to freezing and thawing, concrete from each truck shall be tested and concrete not meeting specified percentages shall not be placed.
 - c. For interior concrete not exposed to freezing and thawing, such as lightweight concrete on metal decking, perform one test for each set of test cylinders.
 - d. Concrete used in performing air content test shall not be used in fabricating test specimens
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, equilibrium unit weight of structural lightweight concrete; one test for each composite sample.
 6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - b. Cast and field cure one cylinder specimen for each composite sample.
 - 1) Store field-cured cylinders as near as possible to location of concrete represented by sample and give cylinder, insofar as practicable, same protection and curing as adjacent concrete.

- c. If additional specimens are required to verify early strength of concrete, contractor must pay for additional testing.
 7. In-Situ Concrete Strength Testing.
 - a. For suspended slab concrete construction, conduct Maturity Testing of concrete placement in accordance with ASTM C 1074 based on temperature-time-strength relationship developed for concrete mixture being utilized.
 - b. Alternatively, mold Cast-In-Place-Punchout-Cylinders (CIPPOCs) in accordance with ASTM C 873.
 8. Compressive-Strength Tests: ASTM C 39.
 - a. Test one cylinder specimen at 7 days for information, and remaining two cylinder specimens at 28 days for acceptance.
 - b. Deliver field-cured specimens to laboratory at 28 days and test to verify adequacy of curing and protection in field.
 - c. 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.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing when requested by the Owner's Representative(Technical 1):
 1. Measurements shall be made prior to removal of forms and shores at elevated structural slabs.
 2. The Contractor shall be notified immediately after the measurements of any section are complete and a written report of the results shall be submitted within 72 hours after finishing operations are complete.
 3. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.

3.19 EVALUATION OF TEST RESULTS

- A. 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.
- B. 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.
- C. Test results shall be reported in writing to Architect, concrete supplier, and Contractor 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.
- D. Nondestructive 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.
- E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete at the expense of the Contractor 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 or by other methods as directed by Architect.

- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- G. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- H. Fill core holes with concrete specified for location.

END OF SECTION 03 3000.2

SECTION 03 3500

POLISHED CONCRETE FINISH SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete polishing and finishing using a mechanical grinding & polishing process.
(Noted as floor finish Type CS-1 on Architectural Finish Plans)
- B. Application of silicate sealer, hardener, and densifier floor finish.

1.2 RELATED SECTIONS

- A. Section 03 3000.2 – Cast-in-Place Concrete: Materials for polished concrete floor, floor finishing and floor flatness.
- B. Section 03 3000.2 – Cast-in-Place Concrete: Floor finishes Types CS-2 and CS-3.
- C. Section 07 9000 - Joint Protection

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM).
 - 1. ASTM C 779/C779M-05 – Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
 - 2. ASTM C1378-04 (2009) Standard Test Method for Determination of Resistance to Staining.
 - 3. ASTM D236- 07 Standard Test Method for Volatile Content of Coatings.
 - 4. ASTM D4060-07 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abrasion: Modified.
 - 5. ASTM D4541-09 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 6. ASTM D5178-98/08 Standard Test Method for Mar Resistance of Organic Coatings.
 - 7. ASTM E 1155 – Standard Test Method for Determining Floor Flatness and of Levelness Using the F number system
- B. American Concrete Institute (ACI):
 - 1. ACI 302 – Guide for Concrete Floor and Slab Construction.
- C. National Floor Safety Institute (NFSI).
 - 1. ANSI/NFSI 101-D: Test Method for Measuring Wet Dynamic Coefficient of Friction (DCOF) of Common Hard-Surface Floor Materials.

1.4 SYSTEM DESCRIPTION

- A. Installation of polished concrete floor system for new interior concrete floor in locations noted on Drawings, by dry or wet grinding and polishing with various size

grit metal-bonded and resin-bonded diamonds, followed by application of concrete densifier.

- B. Sample of finished product is available for review at Architectural Alliance.
- C. Performance Requirements: Improve performance of floor by installation of polished concrete floor system as measured by the following criteria:
 - 1. Floor Flatness Requirements, ASTM E 1155:
 - a. Overall FF 40. F_F50/F_L35
 - b. Local FF 20 > F_F44/F_L25 .
 - 2. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch wear in 30 minutes.
 - 3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
 - 4. Traction Rating: NFSI B101.1, field tested high traction rating.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 3300.
- B. Product Data: Provide data on all products including the following:
 - 1. Information on compatibility of different products and limitations.
 - 2. Material Safety Data Sheets (MSDS).
 - 3. Surface preparation and concrete grinding procedures.
- C. Shop Drawings:
 - 1. Typical layout including dimensions and floor grinding schedule.
 - 2. Plan view of floor and joint pattern layout.
- D. Installation Procedures: Provide manufacturer's recommendations for installation and interface required with adjacent construction.

1.6 INFORMATION SUBMITTALS

- A. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties as cited in Performance Requirements.
- B. Certificates:
 - 1. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
 - 2. Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A.
- C. Installer's Accreditation and Certification:
 - 1. Letter from the Concrete Polishing Technical Institute stating Installer holds a valid and current accreditation.
 - 2. Letter stating that Installer has been certified by the manufacturer of the Hardener / Densifier to be used.
- D. Installer's Project References:

1. Listing of five similar projects that are older than one year. Provide physical address and contact information for each. Include the manufacturer and product-make-model of the hardener / densifier used, equipment used to drive the abrasives and abrasives.
- E. Maintenance Manual: Submit maintenance manual, including maintenance and cleaning instructions for polished concrete floor system.

1.7 QUALITY ASSURANCE

- A. Installer's Qualifications:
 1. Installer shall have a minimum of 10 years' experience with no less than 20 similar projects that are older than one year, and shall provide trained laborers with prior experience in the type of construction involved as well as experience installing the specified process.
 2. Installer shall have a minimum of 5 years' experience in applying specified hardener / densifier, with no less than 5 similar projects product was used and shall provide trained laborers with prior experience in the type of construction involved as well as experience in applying specified product.
- B. Pre-Installation Meeting:
 1. New Flat Work
 - a. New: All parties that influence the results of the polishing process must attend including Polishing/Processing Installer, Flat Work Contractor, Architect, General Contractor and Parties responsible for assuring concrete mix design.
 2. Determine at what stage in construction floors are to be finished.
 3. Review how all parties are to work together and how each influences final results.
- C. Protection of surface before and after processing or polishing installation is the responsibility of the General Contractor and/or installer and shall include:
 1. Protect all finished surfaces with 1/8" hardboard taped together to fully cover the exposed to view final floor area.
 2. Diaper all equipment.
 3. Vehicles are not permitted on surface. Mobile lifts must have wheels that are free of debris that could stain or damage finished surface.
 4. Do not allow acids to contact surface.
 5. Do not place any material onto surface that may cause staining, etching or scratching. Do not store materials directly on finished surfaces.
 6. Protect surfaces from overhead work activities.
 7. Remind all trades they are working on a surface that is to become a finished surface.
- D. The contractor shall conform to regulatory requirements set forth in Section 01 4000 as well as comply with all applicable EPA, OSHA, State, regional and local codes and regulations.

1.8 MOCK-UP

- A. Mockup shall be used by the architect as a reference and general guide to the appearance of the ultimate finished product. When approved, the mockup shall demonstrate minimum standard of quality required for proceeding with this work..
 - 1. Size: 100 square feet in size and in a location designated by architect.
 - 2. Produce using specifications specified for areas to receive concrete processing or polishing.
 - a. Mock-up will be used to show depth of cut / aggregate exposure, clarity of the cut surface, color, sheen, natural variations, and quality of workmanship.
 - b. Concrete processing to be performed with the same abrasives, equipment, hardeners / densifiers and dye to be used in processing permanent flatwork.
- B. Mock-up to be placed and finished by the same concrete flat work contractor responsible for pouring and placing permanent flatwork.
- C. Notify architect 14 days prior to mockup construction and finishing.
- D. If determined mockups do not meet architect's requirements Contractor will remove and replace mockups until architect approval is given.
- E. General Contractor shall maintain mockup during construction and will be used as a general reference to the finished product.
- F. Mockups may not be incorporated into finished work.
- G. General Contractor will be responsible for removal and disposal of mockups.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store products in unopened packaging until ready for installation with packages clearly labeled with the manufacturer's name, type, and, if applicable, color.
- B. Store in a dry, enclosed area protected from exposure to moisture and temperatures below 50 degrees F. Protect from freezing. Keep containers closed and upright to prevent leakage.
- C. Store and dispose of solvent-based materials in accordance with requirements of local authorities having jurisdiction.

1.10 PROJECT CONDITIONS

- A. Protect concrete slabs from staining prior to application of concrete finish system.
 - 1. Diaper hydraulic powered equipment.
 - 2. Place drop cloths under parked vehicles.
 - 3. Do not store structural steel or metal fabrications on slab.
 - 4. Do not allow pipe-cutting machine on slab.
- B. Responsibilities of General Contractor:

1. General Contractor is to maintain temperature, humidity, and ventilation within limits recommended by manufacturer of any products used for application.
 2. General Contractor is to have job site lighting operational and provide sufficient light for the process.
 3. General Contractor is responsible to provide Installer a broom swept floor before work begins.
 4. General Contractor is responsible for removing all debris from floor joints before Installer begins work.
- C. No other trades are allowed in area being work on by Installer and area is to be free and clear of anything that would prevent work from progressing in a timely manner.
- D. In the event solvent based stains are used anything that produces sparks or flames must be turned off.

1.11 WARRANTY

- A. The hardener or densifier manufacturer shall furnish a minimum 10-year material limited warranty, from the date of installation.

PART 2 PRODUCTS

2.1 EQUIPMENT TO BE USED FOR INSTALLATION

- A. Floor Grinder: Type: Multi-orbital, planetary-action, opposing-rotational, diamond-headed floor grinder.
- B. Vacuum System: Ruwac / Ermator (or equivalent) model as determined by installer to perform required dust extraction during grinding and polishing of concrete floor.
- C. Diamond Tooling for Initial Grinding, and Preparing Floor for Polishing:
1. 60-grit metal-bonded diamonds (or equivalent).
- D. Diamond Tooling for Polishing Concrete:
1. 800-grit resin-bonded diamonds (or equivalent).

2.2 MATERIALS

- A. Abrasives are to be tried and proven in a field setting. If requested the manufacturer must supply 10 references of Installers currently using their abrasives and pictures of jobs completed by those Installers. Hardness of abrasive must be matched with hardness of concrete. All resin abrasives must be from the same manufacturer, make and model.
- B. Concrete Densifier/Sealer:
1. Consolideck LS densifier with LS Guard protection
 2. Vexcon Certi-Shine Clear FSR Diamond Polished.
 3. Lythic Densifier/Lythic SPD Protector.
 4. Substitutions: See Section 01 6000 - Product Requirements.

- C. Impregnating Micro Filming Stain Inhibitor must be VOC compliant and have third party data showing performance results whose product is tried and proven in a field setting.
- D. Joint Filler: Refer to Section 07 9000.
- E. Crack Repair Material must be VOC compliant and have third party data showing performance results whose product is tried and proven in a field setting.
- F. Patching Material must be VOC compliant and have third party data showing performance results whose product is tried and proven in a field setting. Color of patching material shall match the concrete floor matrix.
- G. Cement Binder Repair material must be VOC compliant whose product is tried and proven in a field setting.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Flat Work Requirements:
 - 1. New
 - a. Confirm Slab Requirements as outlined in Division 3 Section 03 3000 - Cast In Place Concrete:
 - 1) Concrete must be cured for a minimum of 28 days.
 - 2) Confirm slab has an overall floor flatness rating of at least 50, with a minimum of 40.
 - 3) Confirm slab has floor levelness rating of at least 35, with a minimum of 35.
 - 4) Hard Trowel finish, not burned without hand finishing.
 - 5) Confirm granite aggregate was top broadcast-applied and lightly troweled into top surface.
 - b. Immediately notify Architect of unsatisfactory condition of concrete surface. Do not proceed until surface is in compliance with installers' recommendations or otherwise in writing agreed upon between Installer and Architect.
 - c. Identify and rectify any conditions and/or concerns that will affect final finish. Do not begin installation until substrates have been properly prepared unless otherwise in writing agreed upon between Installer and architect.
 - d. Confirm all conditions as outlined in Paragraph 1.09 Project Conditions have been met.

3.2 PREPARATION

- A. All surrounding areas are to adequately be protected from concrete processing and polishing process.
- B. Remove all adhesives, oil, grease, dirt and previous coatings, sealers, curing agents, bond breakers and other contaminate that would affect the final finish.

-
- C. Concrete Repair:
 - 1. Patching of loose, crumbly or deteriorated concrete must be removed and those areas repaired in accordance with manufacturer's instructions with Patching Material specified in Part 2.
 - 2. Cracks repaired in accordance with manufacturer's instructions with Crack Repair Material specified in Part 2.
 - 3. Joints filled in accordance with manufacturer's instructions with Joint Filling Material specified in Part 2.
 - D. Power sweep floor area, blow out corners and column footings.

3.3 INSTALLATION

- A. The extent of polishing shall extend beyond the face of finished walls surrounding the polished concrete floor area. "Borders" left unpolished or with a finish that doesn't match the main body of the floor area will not be accepted.
- B. Transitions between polished and unpolished, exposed concrete floors shall have a separation
- C. The process is to be performed wet with all grits below 150 resin and wet or dry for the balance of the processes.
- D. Final grit performed per finish specifications.
- E. The number of abrasives under the equipment will be dictated by the specified head pressure needed for proper abrasion to occur by the abrasive manufacturer.
- F. A minimum of two passes in different direction per grit is required.
- G. At no time are any consecutive grits to be skipped following the starting grit abrasive.
- H. The Installer will drop back one grit resin abrasive from the last metal grit abrasive used. A separation in grit designation size must be a minimum of 50 when transitioning from metal to resin.
- I. The Installer will refine the concrete surface with each grit abrasive to its maximum potential before moving on to the next consecutively finer grit. The Installer must refine the concrete surface further than replacing the scratch pattern from the previous grit abrasive with the next grit abrasive.
- J. Each wet grit after 100 metal must be refined until the slurry becomes translucent in the middle and clear around the edges.
- K. Each dry grit abrasive after 100 resin must be refined until the abrasives flowingly move across the surface.
- L. An auto scrubber must be used to clean the floor in between each grit until any particulate grit larger in size then what the next grit cut will produce has been removed from the floor before continuing to the next progressively finer grit.
- M. Polished Concrete Finish System:

1. Removal of Pre-existing Materials
 - a. Remove coatings, sealers, curing agents, bond breakers and glue using an abrasive designed for the particular removal application and one that will cause the least amount of damage to the surface.
2. Grinding
 - a. Small Aggregate Exposure: Grind to consistent 3/16 inch aggregate exposure.
 - b. Work to and stay within specified layer of aggregate.
 - c. Metal abrasive grinding shall not go any higher than 220 unless special circumstances present themselves and approved by architect.
3. Harden / Densify
 - a. Application of a densifier will be dictated by the concrete but will not be applied any later than 150 grit resin unless approved by the architect.
 - b. Densifier shall be applied according to manufacturer's directions.
 - c. Remove residue of concrete densifier dried on floor surface by grinding.
4. Honing
 - a. Start Honing with 100/120 grit resin.
 - b. Follow with 100/120 grit resin with 200/220 grit resin.
 - c. Follow with 200/220 grit resin with 400 grit resin.
- #
5. Polishing
 - a. End polishing processing at the specified level of clarity of reflection.
 - b. Start Polishing with 800 grit resin.
 - c. Follow 800 grit resin with 1500/1800 grit resin.
 - d. Follow 1500/1800 grit resin with 3000/3500 grit resin.
6. Inspection
 - a. Surface must be free from any random scratch patterns.
 - b. All edges must be uniformly cut and processed when compared to the rest of the floor.
 - c. Corrections to be made before application of Impregnating Micro Filming Stain Inhibitor.
7. Impregnating Micro Filming Stain Inhibitor
 - a. Thoroughly power scrub floor, removing all dust and debris prior to application of stain inhibitor.
 - b. Apply according to manufacturer's directions.
- #
8. Perform final buff with burnisher operating at no less than 1500 rpm and pad.

3.4 CLEANING

- A. Perform site clean-up in accordance with Section 01 7000. Remove all excess materials, tools and rubbish from site.
- B. If floors have been exposed to dust and debris since the stain inhibitor application, and are no longer clean, the contractor shall power scrub floors a second time prior to turn over to the Owner.

END OF SECTION

SECTION 03 3816

UNBONDED POST-TENSIONED 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 includes the following:
1. Furnishing post-tensioning reinforcement and accessories including non-encapsulated post-tensioning tendons, pocket formers, support bars, bar chairs, and slab bolsters, and all related accessories including;
 2. Installing post-tensioning tendons.
 3. Performing post-tensioning operations including stressing and finishing tendons.
 4. Recording tendon elongations and gage pressures.
 5. Finishing tendon ends and patching stressing pockets.
- B. Related Requirements:
1. Division 01 Section "Structural Tests and Special Inspections".
 2. Division 03 Section "Concrete Formwork".
 3. Division 03 Section "Concrete Reinforcement".
 4. Division 03 Section "Cast-In-Place Concrete".
 5. Division 05 Sections for items cast into concrete.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
 2. ACI 301 - Specifications for Structural Concrete for Buildings.
 3. ACI 315 - Standards on Details and Detailing of Concrete Reinforcement.
 4. ACI 318 – Building Code Requirements for Reinforced Concrete.
 5. ACI 423.3R – Recommendations for Concrete Members Prestressed with Unbonded Tendons.
 6. ACI 423.6 – Specification for Unbonded Single Strand Tendons.
- B. American Society for Testing and Materials (ASTM).
- C. Council of American Structural Engineers of Minnesota (CASE/MN): Guideline for Special Structural Inspection and Testing.
- D. International Building Code (IBC).
- E. Minnesota State Building Code (MSBC).

- F. Post-Tensioning Institute (PTI):
 - 1. Post-Tensioning Manual.
 - 2. Field Procedures Manual for Unbonded Single Strand Tendons.

1.4 DEFINITIONS

- A. Strand Tail: Excess strand length extending past the anchorage device.
- B. Stressing Blockout: Opening created in the slab to allow access to stressing-end anchorages.
- C. Stressing Pocket: Void formed by pocket former between stressing-end anchorage and edge of slab to allow access for stressing equipment. After stressing this void is filled in with approved grout to provide protection for tendon end.
- D. Wedge Cavity: Cone-shaped hole in anchorage device designed to hold the wedges that anchor the strand.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Post-tensioning coating.
 - 2. Tendon sheathing.
 - 3. Anchorage devices.
 - 4. Tendon couplers.
 - 5. Bar and tendon supports.
 - 6. Pocket formers.
 - 7. Sheathing repair tape.
 - 8. Stressing-pocket patching material.
- B. Shop Drawings: Installation drawings including plans, elevations, sections, details, and notes prepared by or under the supervision of a Specialty Structural Engineer detailing tendon layout and installation procedures, including the following:
 - 1. Provide erection plans, erection details and reinforcing elevations. Cut erection details where details are cut on structural plans and add erection details as needed. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, and cambers. If partial area submittals are made, submit all related sheets and cloud related plan areas. Reference specific structural plans and details from which information is drawn. Phase submittals to match sequence of actual construction. Field verify all existing conditions impacting this work and add field information to shop drawings prior to submittal of shop drawings to Architect /Engineer.
 - 2. Unique tendon identification mark for each tendon shown on shop drawings for field coordination, review of calculated elongations, and verification of recorded elongations during stressing operations.
 - 3. Numbers, groupings, arrangement, spacings, and designation of post-tensioning tendons.
 - 4. Tendon profiles and method of tendon support including chair heights and locations. Show tendon profiles at sufficient scale to clearly indicate all support points, with their associated heights.
 - 5. Placing sequence of post-tensioning tendons and mild reinforcement.
 - 6. Construction joint locations, pour sequence, locations of anchorages and blockouts required for stressing.

7. Stressing procedures and jacking force to result in final effective forces used in determining number of tendons required.
 8. Calculated elongations for each tendon length.
 - a. Informational Calculations, prepared by Specialty Structural Engineer, must accompany shop drawings.
 9. Details for horizontal curvature around openings and at anchorages.
 10. Details for corners and other locations where tendon layouts may conflict with one another or nonprestressed reinforcing steel.
 11. Diagrams, schedules and notes as necessary for positioning of nonprestressed reinforcement required for installing post-tensioning tendons including, but not limited to, the following:
 - a. Support bars.
 - b. Backup bars and hairpins at anchorages.
 - c. Hairpins at locations of horizontal curvature.
 - d. Supplemental reinforcement at blockouts.
- C. Repair Procedures: Provide written documentation and illustrations for repairing damaged tendons, sheathing, and anchorages.
- D. Product Certificates:
 1. For each type of anchorage device and coupler, signed by product manufacturer.
- E. Manufacturer Qualification Data: Prior to any shop drawing submittals, submit documented Quality Control procedures for manufacture and labeling of post-tensioning systems for installation.
- F. Installer Qualification Data: Include resume of individual supervising installation and stressing of post-tensioning tendons.

1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Mill Test Reports: Certified mill test reports for post-tensioning strand used on Project indicating that strand is low-relaxation and including the following:
 1. Coil numbers or identification.
 2. Breaking load.
 3. Load at 1 percent extension.
 4. Elongation at failure.
 5. Modulus of elasticity.
 6. Diameter and net area of strand.
- C. Calculations: Contractor shall engage a specialty structural engineer, to perform final design calculations. Design for the criteria indicated here-in and as shown on the drawings. Submit signed calculations same day as reinforcing shop drawings to which they relate, to ensure compatibility between specialty engineers calculations and shop drawing detailers drawings. Submit sealed calculations indicating method of elongation calculation including values used for friction coefficients, anchorage seating loss, elastic shortening, creep, relaxation, and shrinkage for each tendon length and profile.

- D. Procedures Statement: Procedures for cutting excess strand tail and patching stressing pocket.
- E. Field Use Drawings: Submit two copies to Engineer's office.
- F. Stressing Jack Calibration: Calibration certificates for jacks and gages to be used on Project. Calibrate each jack-and-gage set as a pair.
- G. Stressing Records: Filled out by testing agency during stressing operation and submitted same day as stressing operations with the following information recorded:
 - 1. Name of Project.
 - 2. Date of approved installation drawings used for installation and stressing.
 - 3. Floor number and concrete placement area.
 - 4. Date of stressing operation.
 - 5. Weather conditions including temperature and rainfall.
 - 6. Name and signature of inspector.
 - 7. Name of individual in charge of stressing operation.
 - 8. Serial or identification numbers of jack and gage.
 - 9. Date of jack-and-gage calibration certificates.
 - 10. Gage pressure to achieve required stressing force per supplied calibration chart.
 - 11. Tendon identification mark.
 - 12. Calculated tendon elongation.
 - 13. Actual tendon elongation.
 - 14. Actual gage pressure.
- H. Minutes of Pre-Installation Conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this Section with minimum 5 years of documented experience and record of successful installation. A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 - Field Fundamentals course or has equivalent verifiable experience and knowledge acceptable to Architect.
 - 1. Superintendent must have received training from post-tensioning supplier in the operation of stressing equipment to be used on Project.
- B. Manufacturer Qualifications: Fabricating plant with minimum 10 years experience and certified by PTI according to procedures set forth in PTI's "Manual for Certification of Plants Producing Unbonded Single Strand Tendons", or facility with a currently implemented, written quality control program with requirements which meet or exceed PTI certification requirements.
- C. Specialty Structural Engineer Qualifications: Employ licensed Professional Engineer, registered in Minnesota, and acceptable to Owner, to perform design of tendon stress losses, effective forces, and elongations. Sign and seal design Shop Drawings and design calculations submitted to Owner for review. Comply with design intent, criteria, and requirements of the Contract Documents.
- D. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Testing Agency Inspector: Personnel performing field inspections and measuring elongations shall have successfully completed PTI's Level 1 - Field Fundamentals course or shall have equivalent qualifications acceptable to Architect.
- E. Source Limitations: Obtain post-tensioning materials and equipment from the same supplier.
 1. Stressing jacks not provided by post-tensioning supplier must be calibrated and approved for use on Project by post-tensioning supplier.
- F. ACI Publications: Comply with ACI 423.6, "Specification for Unbonded Single Strand Tendons," unless otherwise indicated in the Contract Documents.
- G. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Section 01 45 33 and Division 01 Section "Project Management and Coordination." Review methods and procedures related to installation and stressing of post-tensioning tendons including, but not limited to, the following:
 1. Construction schedule and availability of materials, personnel, and equipment needed to make progress and avoid delays.
 2. Storage of post-tensioning materials on-site.
 3. Structural load limitations.
 4. Coordination of post-tensioning installation drawings and nonprestressed reinforcing steel placing drawings.
 5. Horizontal and vertical tolerances on tendon and nonprestressed reinforcement placement.
 6. Marking and measuring of elongations.
 7. Submittal of stressing records and requirements for tendon finishing.
 8. Removal of formwork.
 9. Backshoring and/or reshoring procedures.
- H. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Supplier: Deliver, store, and handle post-tensioning materials according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Supplier: Package each tendon bundle at source in heavy plastic, sealed shut, to prevent physical damage to tendon during transportation and storage and to positively protect strand from moisture intrusion during transit and storage. Use heavy padding to protect sheathing from being cut by binding materials. Use filament tape, not wire binding, for bundle tags.
 1. Tendons arriving at jobsite with sheathing cut or damaged due to bundle straps over more than 5% of length shall be cause for rejection of shipment. Damaged length need not be continuous.
 2. Remove and replace at not cost to Owner tendons with wires or strands which are broken or show severe fabrication defects.

- C. Inspect tendons and accessory items at time of their delivery to Project site, prior to off-loading. Notify post-tensioning supplier of observed damage prior to off-loading.
- D. Keep accurate and current records of materials delivered and used.

1.9 COORDINATION

- A. Other trades embedding or attaching work to post-tensioned slabs, joists or beams shall thoroughly coordinate installation of their work and submit detailed shop drawings of installations for review including attachments, sleeves, embedded conduit, and blockouts.
- B. Attachments and Penetrations:
 - 1. Attach permanent fixtures such as curtain-wall systems, handrails, fire-protection equipment, lights, and security devices to the slab using embedded anchors.
 - a. Length of inserts shall not exceed 3 feet, unless specifically coordinated with tendon shop drawings and specifically approved.
 - 2. Drilled anchors are not allowed unless authorized in writing by Architect.
 - 3. Powder-driven fasteners shall not exceed 3/4 inch penetration at areas where the tendon profile approaches the top or bottom slab surface.
 - 4. Core drilling for sleeves or other penetrations is not allowed unless authorized in writing by Engineer.
 - a. Core drilling or cutting of holes through slabs or beams will not be acceptable until all tendons in the vicinity have been located by visual, magnetic, x-ray or other non-destructive means.
 - 5. Sleeve penetrations through beams or drop caps shall not be permitted unless authorized in writing by Engineer.
- C. Inserts of any type shall not interfere with scheduled location or profile of any tendons.

PART 2 PRODUCTS

2.1 GENERAL

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work are limited to PTI Certified Plants specified herein.
 - 1. AMSYSCO, Inc.
 - 2. Dywidag Systems International, USA, Inc.
 - 3. PTE Strand Company.
 - 4. Suncoast Post-Tension L.P.
 - 5. VSL Corporation.

2.3 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A 416, Grade 270, uncoated, 7-wire, low-relaxation strand.
 - 1. 0.5-inch diameter strand at slabs, joists, and beams.
- B. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion-inhibiting properties specified in ACI 423.6; chemically stable and nonreactive with prestressing steel, nonprestressed reinforcement, sheathing material, and concrete.
 - 1. Minimum Coating Weight: per 100 feet of strand:
 - a. 2.5 lb for 0.5-inch diameter strand.
 - 2. Completely fill annular space between strand and sheathing over entire tendon length with post-tensioning coating.
- C. Tendon Sheathing: Comply with ACI 423.6. Polyethylene or polypropylene with a minimum density of 0.034 lb/cu. in.
 - 1. Minimum Thickness: 0.05 inches
 - 2. Continuous over the entire length of tendon between anchorages to prevent intrusion of cement paste or loss of coating for a non-encapsulated system.
 - 3. Color shall contrast with corrosion preventive coating so that sheathing tears will be readily visible. Black/dark colored sheathing is unacceptable.
- D. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements in ACI 423.6 and capable of developing 95 percent of actual breaking strength of strand.
 - 1. Anchorage Bearing Stresses: Comply with ACI 423.6 for stresses at transfer load and service load.
 - 2. Fixed-End Anchorage Device Assemblies: Plant fabricated with wedges seated at a load of not less than 80 percent and not more than 85 percent of breaking strength of strand.

2.4 ACCESSORIES

- A. Pocket Formers: Capable of completely sealing wedge cavity; sized to provide the required cover over the anchorage and allow access for cutting strand tail.
- B. Anchorage Fasteners: Uncoated steel nails, wires, and screws used to attach anchorage devices to formwork.
- C. Sheathing Repair Tape: Elastic, self-adhesive, moistureproof tape with minimum width of 2 inches, in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.
- D. Chairs, Supports and Accessories: Conform to ACI 315. Where exposed to weather or where rust would impair architectural finishes, galvanize or coat with plastic.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 - 1. At visibly exposed locations, grout color shall match adjacent concrete and be reviewed and approved by Architect.

PART 3 EXECUTION

3.1 GENERAL

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.

3.2 FORMWORK

- A. Provide formwork for post-tensioned elements as specified in Division 03 Section "Cast-in-Place Concrete." Design formwork to support load redistribution that may occur during stressing operation. Ensure that formwork does not restrain elastic shortening, camber, or deflection resulting from application of prestressing force.
- B. Do not remove forms supporting post-tensioned elements until tendons have been fully stressed and elongations have been approved by Architect, unless authorized in writing by Architect.
- C. Do not place concrete in supported floors until tendons on supporting floors have been stressed and elongations have been approved by Engineer, unless authorized in writing by Engineer.
- D. Where required elsewhere, perform slab surface measurements for specified Floor Profile Numbers prior to commencing stressing operations.

3.3 NONPRESTRESSED STEEL REINFORCEMENT PLACEMENT

- A. Placement of nonprestressed steel reinforcement is specified in Division 03 Section "Concrete Reinforcement." Coordinate placement of nonprestressed steel reinforcement with installation of post-tensioning tendons.

3.4 TENDON INSTALLATION

- A. Install tendons according to approved installation drawings and procedures stated in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Tendon Supports: Provide continuous slab bolsters or bars supported on individual high chairs spaced at a maximum of 48 inches o.c. to ensure tendons remain in their designated positions during construction operations and concrete placement.
 - 1. Support tendons as required to provide profiles shown on installation drawings. Position supports at high and low points and at intervals not exceeding 48 inches. Ensure that tendon profiles between high and low points are smooth parabolic curves.
 - 2. Attach tendons to supporting chairs and reinforcement without damaging tendon sheathing.
- C. Maintain tendon profile within maximum allowable deviations from design profile as follows:
 - 1. 3/8 inch for member depth greater than 8 inches and less than or equal to 25 inches.
 - 2. 1/2 inch for member depth greater than 25 inches.

-
- D. Maintain minimum radius of curvature of 480-strand diameters (ie: 20-foot radius for 0.5-inch diameter strand) for lateral deviations to avoid openings, ducts, and embedded items. Maintain a minimum of 2 inches of separation between tendons at locations of curvature.
 - E. Limit tendon bundles to four tendons in slabs and six tendons in beams. Do not twist or entwine tendons within a bundle.
 - F. If tendon locations conflict with nonprestressed reinforcement or embedded items, tendon placement governs unless changes are authorized in writing by Engineer. Obtain Engineer's approval before relocating tendons or tendon anchorages that interfere with one another.
 - G. Deviations in horizontal spacing and location of slab tendons are permitted when required to avoid openings and inserts.
 - H. Installation of Anchorage Devices:
 - 1. Place anchorage devices at locations shown on approved installation drawings.
 - 2. Do not switch fixed and stressing-end anchorage locations unless authorized in writing by Architect.
 - 3. Attach pocket formers, intermediate anchorage devices, and stressing-end anchorage devices securely to bulkhead forms. Install stressing-end and intermediate anchorage devices perpendicular to tendon axis.
 - 4. Install tendons straight, without vertical or horizontal curvature, for a minimum of 12 inches behind stressing-end and intermediate anchorages.
 - 5. Embed intermediate anchorage devices at construction joints in first concrete placed at joint.
 - 6. Minimum splice length in reinforcing bars at anchorages is 24 inches. Stagger splices a minimum of 60 inches.
 - 7. Place fixed-end anchorage devices in formwork at locations shown on installation drawings. Support anchorages firmly to avoid movement during concrete placement.
 - 8. Remove loose caps on fixed-end anchorages, refill with post-tensioning coating, and re-attach caps to achieve a watertight enclosure.
 - I. Maintain minimum concrete cover as follows:
 - 1. From Exterior Edge of Concrete to Face of Anchor: 1-1/2 inches for nonaggressive environments.
 - 2. From Exterior Edge of Concrete to Strand Tail: 1 inch.
 - 3. From Exterior Edge of Concrete to Anchor Cap: 1 inch.
 - 4. Top, Bottom, and Edge Cover for Anchorage Devices: 3/4 inch for nonaggressive environments.
 - J. Maintain minimum clearance of 6 inches between tendons and openings.
 - K. Do not install sleeves within 36 inches of anchorages after tendon layout has been inspected unless authorized in writing by Engineer.
 - L. Do not install conduit, pipe, or embeds requiring movement of tendons after tendon layout has been inspected unless authorized in writing by Engineer.
 - M. Do not use couplers unless location has been approved by Engineer.

3.5 SHEATHING INSPECTION AND REPAIR

- A. Inspect sheathing for damage after installing tendons. Repair damaged areas by restoring post-tensioning coating and repairing or replacing tendon sheathing.
 - 1. Ensure that sheathing is watertight and there are no air voids.
 - 2. Follow tape repair procedures in PTT's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Maximum length of exposed strand behind anchorages is as follows:
 - 1. Fixed End: 6 inches.
 - 2. Intermediate and Stressing End: 1 inches.
 - a. Cover exposed strand with sheathing repair tape to prevent contact with concrete.
- C. Immediately remove and replace tendons that have damaged strand.

3.6 CONCRETE PLACEMENT

- A. Do not place concrete until placement of tendons and nonprestressed steel reinforcement has been inspected by special inspector.
- B. Provide Architect and special inspector a minimum of 48 hours' notice before concrete placement.
- C. Ensure compaction of concrete around anchorages.
- D. Ensure that position of tendon and nonprestressed steel reinforcement does not change during concrete placement. Reposition tendons and nonprestressed steel reinforcement moved during concrete placement.
- E. Ensure that method of concrete placement does not damage tendon sheathing. Do not support pump lines, chutes, or other concrete placing equipment on tendons.

3.7 TENDON STRESSING

- A. Calibrate stressing jacks and gages at start of job and at least every six months thereafter. Keep copies of calibration certificates for each jack-and-gage pair on Project site and available for inspection. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.
- B. Stress tendons only under supervision of qualified post-tensioning superintendent and in presence of special inspector.
- C. Do not begin stressing operations until concrete strength has reached 3000 psi as indicated by maturity meters or compression tests of Cast-In-Place Punchout Cylinders (CIPPOCs).
- D. Complete stressing within 72 hours of concrete placement.
- E. If detensioning and restressing of tendon is required, discard wedges used in original stressing and provide new wedges.

- F. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest 1/8 inch.
- G. **Cease stressing operations immediately** if discrepancies between measured and calculated elongations exceed plus or minus 7 percent and cause of deviation is found, documented, and corrected to satisfaction of Engineer prior to recommencing stressing operations.
 - 1. Stressing operations and/or shop drawing elongations must be revised so that final tendon force is in agreement with design requirements.
 - 2. Additional testing and inspecting, at Contractor's expense, will be performed at the discretion of Engineer to determine compliance of replaced or additional work with specified requirements.
- H. Submit stressing records same day as stressing operations.
 - 1. Prestressing will be considered acceptable if gage pressures shown on stressing record correspond to required stressing force and calculated and measured elongations agree within 7 percent.
 - 2. If measured elongations deviate from calculated elongations by more than 7 percent, additional testing, restressing, strengthening, or replacement of affected elements may be required.

3.8 TENDON FINISHING

- A. Do not cut strand tails or cover anchorages until stressing records have been reviewed and approved by Structural Engineer.
- B. Cut strand tails as soon as possible after approval of elongations.
- C. Cut strand tail between 1/2 and 3/4 inch from wedges. Do not damage tendon or concrete during removal of strand tail. Acceptable methods of cutting strand tail, subject to manufacturer's approval, include the following:
 - 1. Oxyacetylene flame.
 - 2. Abrasive wheel.
 - 3. Hydraulic shears.
 - 4. Plasma cutting.
- D. Install caps and sleeves on intermediate anchorages within one day of stressing.
- E. Cut strand tails and install caps on stressing-end anchorages within one day of Engineer's acceptance of elongations.
- F. Grout stressing pockets within one day of cutting strand tail. Clean inside surface of pocket to remove laitance or post-tensioning coating before installing grout material. Finish grout material flush with adjacent concrete.

3.9 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 01 Section "Structural Tests and Special Inspections", and with IBC 2006 Chapter 17 as adopted by the 2007 MSBC, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgement of the Structural Engineer of Record, are critical to the integrity of the building structure.

- B. Cooperate with testing agency to facilitate the execution of its duties.
 - 1. Before concrete placement, special inspector will inspect the following for compliance with post-tensioning installation drawings and the Contract Documents:
 - 2. Location and number of tendons.
 - a. Tendon profiles and cover.
 - b. Installation of backup bars, hairpins, and other nonprestressed reinforcement shown on post-tensioning installation drawings.
 - c. Installation of pocket formers and anchorage devices.
 - d. Repair of damaged sheathing.
 - e. Connections between sheathing and anchorage devices.
 - f. Special inspector will record tendon elongations during stressing.
 - 3. Special inspector will immediately report deviations from the Contract Documents to Engineer.

3.10 PROTECTION

- A. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade component.
- B. Protect exposed components within one workday of their exposure during installation.
- C. Prevent water from entering tendons during installation and stressing.
- D. Provide weather protection to stressing-end anchorages if weather forecasts precipitation, if strand tails are not cut within 10 days of stressing the tendons, or to prevent any other source of water from getting into tendon sheathing during construction.

3.11 REPAIRS

- A. Submit repair procedure to Architect for evaluation and approval.
- B. Do not proceed with repairs requiring removal of concrete unless authorized in writing by Architect.

END OF SECTION 03 3816

SECTION 03 4100.2

PRECAST STRUCTURAL 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. Section Includes:
 - 1. Precast hollow core planks.
 - 2. Precast rectangular and inverted tee beams.
 - 3. Precast structural concrete wall panels.
- B. Related Sections:
 - 1. Division 01 Section "Structural Tests and Special Inspection" for independent testing agency procedures and administrative requirements.
 - 2. Division 03 Section "Cast-in-Place Concrete" for concrete topping and placing connection anchors in concrete.
 - 3. Division 05 Section "Structural Steel" for furnishing and installing connections attached to structural-steel framing.
 - 4. Division 05 Section "Metal Fabrications" for kickers and other miscellaneous steel shapes.
 - 5. Division 07 Section "Through-Penetration Firestop Systems" for joint-filler materials for fire-resistance-rated construction.
 - 6. Division 07 Section "Joint Sealants" for elastomeric joint sealants and sealant backings.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - 2. ACI 306.1 – Standard Specification for Cold Weather Concreting.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code - Steel.
 - 2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
 - 3. AWS C5.4 – Recommended Practices for Stud Welding.
- D. Precast Concrete Institute (PCI):
 - 1. PCI 116 – Quality Control for Plants and Production of Structural Precast and Prestressed Concrete Products.
 - 2. PCI 120 – Design Handbook – Precast and Prestressed Concrete.

3. PCI 135 – Tolerance Manual for Precast and Prestressed Concrete Construction.
 4. PCI TR-6 – Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants.
- E. The Society for Protective Coatings (SSPC): SSPC Paint 20 - Zinc-Rich Coating.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design precast structural concrete, including comprehensive engineering analysis by a qualified specialty structural engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.
- C. Fire Rating: Design slabs to conform to requirements of IBC and UL for fire rated components.

1.5 SUBMITTALS

- A. Shop Drawings: Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement. Detail fabrication and installation of precast structural concrete units.
 1. Indicate joints, reveals, and extent and location of each surface finish.
 2. Indicate separate face and backup mixture locations and thicknesses.
 3. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
 4. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
 5. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 6. Include and locate openings larger than by 10 inches.
 7. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
 8. Indicate relationship of precast structural concrete units to adjacent materials.
 9. Indicate estimated camber for precast floor slabs with concrete toppings.
 10. Indicate shim sizes and grouting sequence.
 11. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- B. Calculations:
 1. Submit design calculations of members and connections to the Architect for review and approval if requested.
 2. Include predicted beam, girder and slab deformations at each stage including after erection, after application of dead loads and after long term live and dead loads.
 3. Calculations for precast design shall be prepared and signed by qualified specialty structural engineer licensed in the State of Minnesota.

- C. Samples: Submit two 12 inches x 16 inches representative samples of precast concrete wall panels for approval before fabrication.
- D. Certification:
 - 1. Submit to the Architect written certification that precast concrete members comply with the IBC requirements for fire rating.
 - 2. Precast concrete slabs: two or three hour rating as noted on the Drawings.
 - 3. Beams: two hour rating.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Participates in PCI's Plant Certification program and is designated a PCI-certified plant as follows:
 - a. Group C, Category C2 - Prestressed Hollow core and Repetitively Produced Products.
- B. Installer Qualifications: A precast concrete erector qualified, as evidenced by PCI's Certificate of Compliance, to erect Category S1 - Simple Structural Systems.
- C. Specialty Structural Engineer Qualifications: Employ Professional Engineer, registered in Minnesota, to perform design of precast structural elements and connections. Sign and seal design Shop Drawings submitted to Owner for review.
- D. Design Standards: Comply with ACI 318 and design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."
 - 2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
 - 1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
 - 2. Place adequate dunnage of even thickness between each unit.
 - 3. Place stored units so identification marks are clearly visible, and units can be inspected.

- C. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that would cause cracking or damage.
- D. Lift and support units only at designated points shown on Shop Drawings.

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 FIELD MEASUREMENTS

- A. Verify actual locations of existing structure, new work previously placed and other construction to which the new work must fit by accurate field measurements before submittal of related shop drawings or fabrication. Show recorded measurements on shop drawings submitted for review.
- B. Coordinate fabrication schedule with construction progress to avoid delay of Work.
- C. Where work will be connected to existing masonry or concrete, contractor shall engage a testing agency to pre-locate hidden embeds and reinforcing steel prior to submittal of shop drawings.
- D. Provide templates and dimensions to fabricator for accurate alignment with existing conditions. Show field conditions impacting the work on the shop drawings, prior to submittal.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 775, epoxy coated.
- C. Epoxy-Coated-Steel Wire: ASTM A 884, Class A coated, plain, flat sheet, Type 1 bendable coating.
- D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.2 PRESTRESSING TENDONS

- A. Pretensioning Strand: ASTM A 416, Grade 250 or Grade 270, uncoated, 7-wire or ASTM A 886, Grade 270, indented, 7-wire, low-relaxation strand.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

- B. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- D. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.4 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36.
- B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
- C. High-Strength Bolts and Nuts: ASTM A 325 or ASTM A 490, Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563; and hardened carbon-steel washers, ASTM F 436 .
 - 1. Do not zinc coat ASTM A 490 bolts.
- D. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123 or ASTM A 153.
 - 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC-Paint 20.
- E. Welding Electrodes: Comply with AWS standards.
- F. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.5 BEARING PADS

- A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi , ASTM D 412.
 - 2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test 1 specimen for every 200 pads used in Project.

2.6 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or 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.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218.
- D. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 116.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.8 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1 and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

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- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 3. Place reinforcement to maintain at least 3/4-inch minimum coverage. Increase cover requirements according to ACI 318 when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
- F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses.
- G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
 5. Protect strand ends and anchorages with a minimum of 1-inch thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.
- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

- J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.
 - 1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- K. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- L. Comply with PCI MNL 116 procedures for hot-weather concrete placement.
- M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that will not show in finished structure.
- N. Affix hour rating label of Underwriter's Laboratory to each unit.
- O. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- P. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.9 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.

2.10 COMMERCIAL FINISHES

- A. Standard Grade: Normal plant-run finish produced in molds that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are permitted. Fill air holes greater than 1/4 inch in width that occur more than once per 2 sq. in. Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Limit joint offsets to 1/8 inch.
- B. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.
- C. Apply roughened surface finish according to ACI 318 to precast concrete units that will receive concrete topping after installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting, cast-in-place, building structural framing has attained minimum allowable design compressive strength or until supporting steel or other structure is complete.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, supports, and bracing as required to maintain position, stability, and alignment of units until permanent connection.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Finish erected members neatly and fully with exposed underside free of stains, dirt, blemishes, drips and grout seepage.
 - 5. For hollow core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.
 - 6. Fill with joint backer rod and seal underside of exposed joints of precast slabs.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Field cutting of precast units is not permitted without approval of the Architect.
- E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- F. Welding: Comply with applicable AWS D1.1 and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.

2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
 3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 4. Remove, reweld, or repair incomplete and defective welds.
- G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
- H. Grouting: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled.
1. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.
 2. Fill joints completely without seepage to other surfaces.
 3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different grout surface levels not steeper than 1 to 12.
 4. Place grout end cap or dam in voids at ends of hollow core slabs.
 5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
 6. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.4 FIELD QUALITY CONTROL

- A. See Division 01 Section "Structural Tests and Special Inspections" for testing and inspection requirements.
- B. Special Inspection and Testing Criteria
 1. Welding (Field)
 - a. Fillet Welds (Technical II)
 - 1) Visually inspect 100% of all fillet welds for size, length and quality per AWS D1.1.
 2. Structural Configuration
 - a. Detail Compatibility (Structural I) On a periodic basis:
 - 1) Review project documents affecting integrity of the structure, including contract documents and pertinent submittals (approved shop drawings)
 - 2) Visit site, at intervals appropriate to the stage of construction, to perform review of the structure and visually confirm general compliance with the project documents.

- 3) Inspect the following to verify member orientation, configuration, type and size comply with details indicated on the contract documents and approved shop drawings:
 - a) Proper applications of joint details at connections for structural members.
 - b) Other work critical to the integrity of the building structure.

3.5 REPAIRS

- A. Repair precast structural concrete units if permitted by Architect.
 1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.6 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 4100.2

SECTION 04 0503

MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Natural color mortar for concrete masonry
 - 2. Pigmented mortar for face brick.
 - 3. Grout for masonry.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 04 2000 - Unit Masonry: Installation of mortar and grout.
 - 3. Section 04 4216 - Steel-Stud-Supported Stone Cladding.
 - 4. Section 08 8113 – Hollow Metal Doors and Frames: Grouting steel door frames.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 530 - Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 - Specifications for Masonry Structures.

- B. ASTM International:
 - 1. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
 - 2. ASTM C91 - Standard Specification for Masonry Cement.
 - 3. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - 4. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
 - 5. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 6. ASTM C150 - Standard Specification for Portland Cement.
 - 7. ASTM C199 - Standard Test Method for Pier Test for Refractory Mortars.
 - 8. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
 - 9. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
 - 10. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
 - 11. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
 - 12. ASTM C476 - Standard Specification for Grout for Masonry.
 - 13. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
 - 14. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 15. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
 - 16. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
 - 17. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.

18. ASTM C1329 - Standard Specification for Mortar Cement.
19. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Samples: Submit samples of mortar, illustrating mortar color and color range.
- C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
- D. Test Reports:
 1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports to ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.
 2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476 and test and evaluation reports to ASTM C1019.
- E. Manufacturer's Installation Instructions: Submit premix mortar manufacturer's installation instructions.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each

component. Indicate the percentage by weight of each component per unit of product.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Portland Cement: ASTM C150, Type I, gray color.
- B. Blended Cement: ASTM C595; Type P, gray color.
- C. Mortar Cement: ASTM C1329, Types M, S, or N, gray color.
- D. Extended Life Mortar: ASTM C1142, Types M, S, or N, gray color cement.
- E. Premix Mortar: ASTM C387, Types M, S, or N, gray color cement.
- F. Masonry Cement: Not permitted.
- G. Mortar Aggregate: ASTM C144, standard masonry type.
- H. Hydrated Lime: ASTM C207, Type S.
- I. Grout Aggregate: ASTM C404, fine and coarse.
- J. Water: Clean and potable.
- K. Mortar Color: Mineral oxide pigment
 - 1. Color for all face brick mortar to be Prism Pigments #P3110, "Light Buff" or equivalent by an acceptable manufacturer.
 - 2. Acceptable manufacturers include:
 - a. Bayer Corp./Bayferroux Pigments.
 - b. Davis Colors.
 - c. New Riverside Ochre Co., Inc.

- d. Prism Pigments.
 - e. L.M. Scofield Company.
 - f. Substitutions: Under provisions of Section 01 6000.
- L. Calcium chloride is not permitted.

2.2 MIXES

- A. Mortar Mixes:
1. Mortar For Structural Masonry: ASTM C270, Type S or N using the Proportion specification.
 2. Mortar For Non-Structural Masonry: ASTM C270, Type N or O using the Proportion specification.
- B. Mortar Mixing:
1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
 2. Achieve uniformly damp sand immediately before mixing process.
 3. Add mortar color to achieve uniformity of mix and coloration.
 4. Re-temper only within two hours of mixing.
 5. Do not use anti-freeze compounds to lower the freezing point of mortar or grout.
- C. Grout Mixes:
1. Grout for Non-Structural Masonry: 2000 psi minimum strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 grout.
 2. Grout for Structural Masonry: 3000 psi minimum strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 grout; maximum size coarse aggregate: 1/2 inch.
 3. Application:
 - a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
 - b. Fine Grout: For grouting other spaces.
- D. Grout Mixing:
1. Mix grout in accordance with ASTM C94/C94M, modified to use ingredients complying with ASTM C476.
 2. Add admixtures; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Request inspection of spaces to be grouted.

3.2 INSTALLATION

- A. Install mortar and grout in accordance with ACI 530.1 Specifications for Masonry Structures.

3.3 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Establishing Mortar Mix: In accordance with ASTM C270.
- C. Testing Frequency: One set of specified tests for every 5,000 sf of completed wall area.
- D. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.
- E. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.

3.4 SCHEDULES

- A. Exterior Cavity Wall: Brick masonry with Type S mortar with Type N pointing mortar.
- B. Masonry below grade and earth contact: Type M mortar.
- C. Interior load-bearing masonry and exterior non-load-bearing masonry: Type N mortar.

END OF SECTION

SECTION 04 2000

UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Face brick units.
 - 2. Concrete masonry units.
 - 3. Reinforcement, anchorage, and accessories

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 4100 – Precast Structural Concrete: Product requirements for precast concrete dovetail slots for placement by this section.
 - 3. Section 04 0503 - Masonry Mortar and Grout: Mortar and grout.
 - 4. Section 05 5000 - Metal Fabrications: Product requirements for fabricated steel items for placement by this section.
 - 5. Section 07 2113 - Board Insulation: Insulation for cavity spaces.
 - 6. Section 07 2600 - Vapor Retarders: Vapor retarder membrane
 - 7. Section 07 6200 - Sheet Metal Flashing and Trim: Product requirements for reglets for flashings for placement by this section.
 - 8. Section 07 8400 - Firestopping: Firestopping at penetrations of masonry work.
 - 9. Section 07 9000 - Joint Protection: Rod and sealant at control joints.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 5. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
 - 6. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 7. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 8. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
 - 9. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.

10. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 11. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
 12. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 13. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
 14. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
 15. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
 16. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 17. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
 18. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 19. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
 20. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 21. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 22. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Product Data:
1. Submit data for masonry units and fabricated wire reinforcement, wall ties, anchors and other accessories.
 2. Indicate initial rate of absorption for clay and shale brick.
- C. Shop Drawings: For reinforced load-bearing masonry walls provide erection plans, details and layout elevations. Indicate sizes, spacing, locations, and quantities of reinforcing steel, bending and cutting schedules, splicing, stirrup spacing, and supporting and spacing devices. Provide references to specific architectural and structural plans, elevations and details from which information is drawn.

- D. Sample Panels: Build sample panels for each type of exposed brick masonry construction in sizes approximately 60 inches long by 48 inches high.
1. Clean one-half of exposed faces of panels with masonry cleaner specified.
 2. Protect approved sample panels from the elements with weather-resistant membrane.
 3. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- E. Manufacturer's Certificates: Submit test reports to certify that masonry products meet or exceed specified requirements for compressive strength, absorption, weight, moisture content and dimensions for each type of masonry unit.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.
- B. Masonry construction techniques shall be in accordance with the current Minnesota State Building Code.
- C. Special Structural Testing and Inspections as required by the current edition of International Building Code, and as adopted by the current Minnesota State Building Code, and shall be performed by qualified parties as specified herein and in accordance with the provisions of Section 01 4000.
- D. Where fire-rating classifications are shown or scheduled for masonry construction (1 hour, 2 hour and similar designations), provide materials and masonry construction techniques certified by Underwriters Laboratories, Inc.
 - 1. Tested Rating: Determined in accordance with ASTM E119.
- E. Surface Burning Characteristics:
 - 1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation insert.

1.6 QUALIFICATIONS

- A. Contractor responsibilities shall include:
 - 1. Manufacturer/Product Quality Assurance:
 - a. Qualifications: Company specializing in manufacture of the products specified in this section, with minimum five years documented experience.
 - b. Only one manufacturer may be used for each type of unit masonry specified. Each type of unit masonry type shall be cured by only one process.
 - c. Only one source or brand of mortar materials may be used during course of the work.

1.7 MOCKUP

- A. Section 01 4000 - Quality Requirements: Mockup requirements.
- B. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- C. Build mockups for each type of exposed brick masonry construction, including weeps and other accessories.
 - 1. Build mockup of typical window, with head and sill condition, and parapet, including metal flashing.
 - 2. Include a sealant-filled joint in each exterior wall mockup.

3. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 4. Include metal studs, sheathing, insulation, veneer anchors, flashing, cavity vents and weep holes in exterior masonry-veneer wall mockup.
- D. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 - E. Protect accepted mockups from the elements with weather-resistant membrane.
 - F. Approval 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.
 1. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - G. Mockups to be constructed as part of larger mockup including all exterior materials and windows.
 - H. Approved mockups may not become part of the completed Work.

1.8 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged products in original unopened containers, under provisions of Section 01 6000.
- B. Store cementitious ingredients on elevated platforms in weather tight enclosures and protect against contamination and warehouse set.
- C. Stockpile aggregates to prevent contamination from foreign materials.
- D. Store concrete block off ground on level platforms that allow air circulation under stacked block. Cover and protect against wetting.
- E. Store brick off ground to prevent contamination by mud, dust, or materials likely to cause staining or other defects.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.

- B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

1.11 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate masonry work with installation of window and door anchors.

1.12 EXTRA MATERIALS

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Deliver a minimum of 50 face brick for each brick type and color utilized on the project for use by the owner for future patching or repair.
- C. Clearly identify each container of material.

PART 2 PRODUCTS

2.1 ACCEPTABLE CONCRETE MASONRY UNIT MANUFACTURERS

- A. All CMU:
 - 1. Masterblock /Aggregate Industries.
 - 2. Amcon Block and Precast, Inc.
 - 3. Anchor Block Company.
 - 4. County Materials Corporation / Premier Block.
- B. Substitutions: Under provisions of Section 01 6000.

2.2 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units (CMU): ASTM C90, moisture controlled, accelerated cure by CO₂ or autoclave; normal weight unless otherwise indicated.
- B. Solid Load-Bearing Block Units (CMU): ASTM C90, moisture controlled, accelerated cure by CO₂ or autoclave; normal weight unless otherwise indicated.
- C. Hollow Non-load Bearing Block Units (CMU): ASTM C129, Type I - Moisture Controlled, normal weight unless otherwise indicated. Intended for use at non-rated interior partitions only.

- D. Concrete Masonry Unit Size and Shape: Nominal modular size of 8 x 8 x 16 inches. Furnish special units for 90 degree corners, bond beams, lintels, and jamb units.

2.3 FACE BRICK UNITS

- A. Face Brick: ASTM C-216, Type FBS, Grade SW.
- B. Basis of Design:
1. Endicott Clay Products
 2. Color: Blend of 80% Medium Ironspot 77 and 20% Medium Ironspot 46; Velour texture.
- C. Brick Sizes and Shapes:
1. Typical Shape (*FB-1*): Norman style brick with dimensions of 3-5/8 inches wide by 2-1/4 inches high by 11-5/8 inches long.
 2. Soldier and Clipped Header Courses (*FB-2*): Modular brick with dimensions of 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 3. Special Brick Shapes:
 - a. Shaped to profiles indicated on Drawings including square corners at soldier courses, 90 degree corner units, and lipped lintel units for header, soldier and stretcher units.
- D. Substitutions by other brick manufacturers will be considered based on matching the color, shape, size and performance of the specified brick under provisions of Section 01 6000. Submit brick samples and test data for evaluation by the Architect.

2.4 REINFORCEMENT

- A. Acceptable Manufacturers for Reinforcement:
1. Heckmann Building Products Inc.
 2. Dur-O-Wal by Hohmann & Barnard, Inc.
 3. Wire-Bond.
- B. Single Wythe Joint Reinforcement: ASTM A951; Prefabricated steel truss or ladder type; 1/8 inch diameter side rods with 1/8 inch diameter cross ties and cross rods at not more than 16 inches (400 mm) o.c.
1. Provide Dur-O-Wal DA 3100 or DA 3200 Series, or equivalent products by approved manufacturers.
 2. Finish to be hot dip galvanized to ASTM A153, Class B-2 for interior walls and ASTM A580, Type 304 stainless steel for exterior walls.
- C. Horizontal Multiple Wythe Joint Reinforcement: ASTM A951; Prefabricated steel truss type; 3/16 inch diameter side rods with 3/16 inch diameter rectangular tab ties. For use where joints of facing wythe are aligned with joints of back-up wythe, and backing and facing wythes are of similar material.
1. Provide Dur-O-Wal DA 3500, "Dur-O-Tab" Series, or equivalent products by approved manufacturers.
 2. Ladder type reinforcement is acceptable where back-up masonry wythe is reinforced vertically.

3. Finish to be ASTM A580, Type 304 stainless steel.
- D. Adjustable Multiple Wythe Joint Reinforcement: Prefabricated steel truss type; 3/16 inch diameter side rods with 3/16 inch diameter rectangular tab ties. For use where facing wythe is of different material than back-up wythe, or where horizontal joints of facing wythe do not align with those of back-up.
1. Provide Dur-O-Wal DA 3300, "Adjustable Dur-O-Tab w/Restraint Bar" Series, or equivalent products by approved manufacturers.
 2. Ladder type reinforcement is acceptable where back-up masonry wythe is reinforced vertically.
 3. Finish to be ASTM A580, Type 304 stainless steel.
- E. Reinforcing Steel: ASTM A615, 60-yield grade; deformed billet steel bars; plain
- F. Strap Anchors: bent steel shape; ASTM A153/A153M hot dip galvanized]. Use to anchor masonry walls to steel columns and beams, masonry walls to concrete walls, or other structural elements.
- G. Mortar and Grout: As specified in Section 04 0503.

2.5 VENEER ANCHORS

- A. Acceptable Manufacturers for Veneer Anchors:
1. Heckmann Building Products Inc.
 2. Dur-O-Wal by Hohmann & Barnard, Inc.
 3. Wire - Bond.
- B. Masonry Veneer to Metal Studs (penetrating through insulation and exterior sheathing):
1. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom, pronged legs of length to match thickness of insulation and sheathing, and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, foam seal gasket manufactured to fit behind anchor plate and extend beyond pronged legs.
 - a. Provide Dur-O-Wall DA 210X anchor plates with DA 700 Triangular ties, and fasteners with neoprene sealing washers.
 - 1) Finish to be ASTM A580, Type 304 stainless steel for anchor plate and ASTM A580, Type 304 stainless steel for wire tie.
 - b. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
 - 1) Manufacturers:
 - a) Heckmann Building Products, Inc.
 - b) ITW Buildex

- C. Masonry Veneer to Masonry Block: Prefabricated steel truss type; 3/16 inch diameter side rods with 3/16 inch diameter rectangular tab ties. For use where facing wythe is of different material than back-up wythe, or where horizontal joints of facing wythe do not align with those of back-up.
 - 1. Provide Dur-O-Wal DA 3300, "Adjustable Dur-O-Tab w/Restraint Bar" Series, or equivalent products by approved manufacturers.
 - 2. Ladder type reinforcement is acceptable where back-up masonry wythe is reinforced vertically.
 - 3. Anchor and tie finish to be ASTM A580, Type 304 stainless steel.
- D. Masonry Veneer to Steel: Two-piece, adjustable veneer anchor consisting of a 12 gauge, weldable, anchor strap with 3/16 inch (5 mm) triangular wire ties.
 - 1. Provide Dur-O-Wal DA 207 anchor with DA 700 Series Ties, or equivalent products by approved manufacturers.
 - 2. Anchor and tie finish to be hot dip galvanized to ASTM A153, Class B-2.
- E. Masonry Veneer to Concrete (Cast in Place and Precast): Two-piece adjustable dovetail anchor consisting of a 22 gauge cast-in-place, dovetail slot with 12 gauge anchor clips factory assembled to 3/16 inch (5 mm) triangular wire ties.
 - 1. Provide Dur-O-Wal DA 100 dovetail slot with DA 720-724 anchor, or equivalent products by approved manufacturers.
 - 2. Anchor and tie finish to be ASTM A580, Type 304 stainless steel.

2.6 MASONRY FLASHINGS

- A. Plastic or PVC Flashings: Not Acceptable.
- B. Composite Copper/Fabric Flashing: 5 oz. per sq. ft. rolled copper sheeting laminated between two layers of fiberglass fabric impregnated with a polymer modified asphalt. Acceptable manufacturers include the following:
 - 1. Afco Products.
 - 2. Advanced Building Products.
 - 3. Hohmann & Barnard, Inc.
 - 4. Polytite Manufacturing Corporation.
 - 5. Sandell Manufacturing.
 - 6. Williams Products, Inc.
 - 7. York Manufacturing, Inc.
- C. Stainless Steel: ASTM A666, Type 304, soft temper; 0.015 inch thick; smooth finish.
- D. Drip Edge Flashing: Minimum 1 1/2 inches wide, 26 ga, Type 304 stainless steel with 3/8 inch hem brake-formed to a 45° drip. Provide in no less than 10 foot lengths.
- E. Lap Sealant: Type as specified in Section 07 9000.

2.7 ACCESSORIES

- A. Weep Tubes: 3/8 inch (10 mm), medium density clear plastic tube as manufactured by Dur-O-Wal, or approved equivalent.

- B. Brick Vents: Molded polyvinyl chloride grilles; insect resistant.
- C. Compressible Filler: Closed cell neoprene sponge conforming to ASTM D-2240, thickness as indicated on Drawings, 3 inches (75 mm) wide. For use at vertical control joints and below horizontal relieving angles.
- D. Preformed Control Joints: Fabricated from extruded rubber compound complying with ASTM D 2000, Designation 2AA-805; designed to fit standard block and to maintain lateral stability in masonry wall; size and configuration as indicated. Furnish with corner and tee accessories, cement fused joints.
- E. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber; or D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- F. Cavity Drain Material: Open, free draining polyethylene mesh thickness required to fill cavity space, and shaped to ensure moisture drainage to cavity weeps.
 - 1. Approved Products:
 - a. Advanced Building Products, Inc.
 - b. CavClear/Archovations Inc.
 - c. Mortar Net USA, Ltd.
 - d. Dur-O-Wal, Inc.
 - e. Substitutions: Section 01 6000 - Product Requirements.
 - 2. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
 - b. Strips, not less than 10 inches wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
- G. Building Paper: ASTM D226; Type I, No. 15 unperforated asphalt felt.
- H. Cleaning Solution: Manufacturer's approved standard-strength acidic cleaner designed for removing mortar stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces.
- I. Steel Lintel Angles: Size as indicated on Drawings, hot-dip galvanized and primed. Provided by steel supplier and installed by masonry contractor.
 - 1. Follow manufacturers instructions for installation and application.
 - 2. Substitutions under the provisions of Section 01 6000.

2.8 SOURCE QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Test brick efflorescence in accordance with ASTM C67. Brick rated greater than "slightly effloresced" is not acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive work.
- C. Verify items provided by other sections of work are properly sized and located.
- D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.
- C. Coursing of Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.
- D. Coursing of Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.4 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.

- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- G. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, or cavity insulation vapor retarder adhesive is applied.
- H. Isolate masonry from vertical structural framing members with movement joints as indicated on Drawings.
- I. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.
- J. Weeps and Vents: Furnish weeps and vents in outer wythe at 24 inches oc horizontally. Locate above through-wall flashing, above shelf angles and lintels, and at bottom of walls
- K. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor retarder adhesive.
 - 1. Install cavity drain material continuously at bottom of each cavity above through wall flashing.

3.5 SINGLE WYTHE MASONRY JOINT REINFORCEMENT AND ANCHORAGE

- A. Install horizontal joint reinforcement 16 inches oc.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Reinforce joint corners and intersections with strap anchors 16 inches oc.

3.6 MASONRY VENEER JOINT REINFORCEMENT AND ANCHORAGE

- A. Install horizontal joint reinforcement 16 inches oc.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.

- E. Secure wall tie anchors to stud framed backing and embed into masonry veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.
- F. Place wall ties at maximum 8 inches on center horizontally within 8 inches of head and sill of wall openings.
- G. Reinforce joint corners and intersections with strap anchors 16 inches oc.

3.7 CAVITY WALL MASONRY JOINT REINFORCEMENT AND ANCHORAGES

- A. Install horizontal joint reinforcement 16 inches oc.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.

3.8 MASONRY FLASHINGS

- A. Extend flashings horizontally 1/4" beyond exterior face of outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls, and as indicated on Drawings, and turn down on outside face to form drip.
- B. Turn through-wall flashings up minimum 8 inches and bed into mortar joint of masonry or seal to concrete or sheathing over steel stud framed backing.
- C. Flashing above doors, mechanical louvers and windows to be seamless and end dammed.
- D. Lap end joints minimum 6 inches and seal watertight. Seal flashing joints per methods and materials recommended by flashing manufacturer.
- E. Turn flashing, fold, and seal at corners, bends, and interruptions. Where masonry anchors penetrate flashing, seal holes around anchors with flashing mastic. Form end dams 2 1/2" high minimum at flashing terminations within cavity walls.

3.9 LINTELS

- A. Install lintels over openings where noted on Drawings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
- C. Unit Masonry Lintel Reinforcement:

1. For openings up to 42 inches (1070 mm) Wide: Place two No.4 reinforcing bars one inch (25 mm) from bottom web.
 2. For openings from 42 inches (1070 mm) to 78 inches (1980 mm) Wide: Place two No. 6 reinforcing bars one inch (25 mm) from bottom web.
 3. For Openings Over 78 inches (1980 mm): Reinforce openings as detailed on Drawings.
- D. Do not splice reinforcing bars.
- E. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- F. Place and consolidate grout fill without displacing reinforcing.
- G. Allow masonry lintels to attain specified strength before removing temporary supports.
- H. Maintain minimum 8 inch bearing on masonry on each side of opening.

3.10 GROUTED COMPONENTS

- A. Reinforce bond beam with two (2), No. 5 bars, 1 inch from bottom web.
- B. Reinforce pilasters and piers as detailed on Drawings.
- C. Lap splices a minimum of 24 bar diameters or as required by code.
- D. Support and secure reinforcing bars from displacement.
- E. Place and consolidate grout fill without displacing reinforcing.
- F. At bearing locations, fill masonry cores with grout for minimum 16 inches both sides of opening.

3.11 REINFORCED MASONRY

- A. Lay masonry units with cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
- B. Place reinforcement bars as indicated on Drawings.
- C. Splice reinforcement in accordance with Section 03 2000.
- D. Support and secure reinforcement from displacement.
- E. Place and consolidate grout fill without displacing reinforcing.
- F. Place grout in accordance with TMS MSJC Specification.

3.12 CONTROL AND EXPANSION JOINTS FOR CMU WALLS

- A. Install control joints at the following maximum spacings, unless otherwise indicated on Drawings:
 - 1. Exterior Walls: Maximum 20 feet on center and within 24 inches on one side of each interior and exterior corner.
 - 2. Interior Walls: Maximum 30 feet on center.
 - 3. At changes in wall height.
- B. Do not continue horizontal joint reinforcement through control joints.
 - 1. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
 - 2. Size control joint in accordance with Section 07 9000 for sealant performance. Typical control joint width is 3/8 inch.
- C. Form expansion joint by omitting mortar and cutting unit to form open space.

3.13 EXPANSION/CONTRACTION (SOFT) JOINTS AT BRICK VENEER

- A. Do not continue horizontal joint reinforcing across expansion joints.
- B. Joints shall be full depth of brick wythe continuous vertically by means of joints between full, cut or broken bricks. Typical control joint width is 3/8 inch (10 mm).
- C. Utilize compressible filler or preformed control joints behind sealant. Refer to Section 07 9000 for sealant specifications.
- D. Utilize felt bond breaker at joints where brick changes direction.
- E. Place brick ties in greater than average density each side of expansion joints.
- F. Provide soft joints in exterior exposed brick masonry walls as indicated on Drawings, or a maximum spacing of 20 feet. Verify soft joint layout and locations with Architect prior to commencement of construction.
- G. Provide soft joints as close as practicable to outside building corners (both sides of corners) and at inside corners.

3.14 BUILT-IN WORK

- A. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates and other items to be built-in the work and furnished by other Sections.
- B. Install built-in items plumb and level.

- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build in materials subject to deterioration.
- E. Cutting And Fitting:
 - 1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
 - 2. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Alignment of Columns: 1/4 inch.
- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.
- I. Maximum Variation for Steel Reinforcement:
 - 1. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
 - 2. Plus or minus 1 inch when distance is between 8 and 24 inches.
 - 3. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
 - 4. Plus or minus 2 inches from location along face of wall.

3.16 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Brick Units: Test each type in accordance with ASTM C67, 5 random units for each 50,000 units installed.
- C. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.17 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with a non-acidic solution that will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners.
- E. Use non-metallic tools in cleaning operations.

3.18 PROTECTION OF FINISHED WORK

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect exposed external corners subject to damage.
- C. Protect base of walls from mud and mortar splatter.
- D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.
- E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION

SECTION 04 4200

EXTERIOR STONE CLADDING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Cut dimension granite veneer with cut in reveals at exterior walls.
 - 2. Panels mechanically anchored (field installed) on a metal support system.
 - 3. Metal anchors and supports.
 - 4. Joint sealing.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 5000 - Metal Fabrications: Supports and metal fabricated items for cut stone.
 - 3. Section 07 9000 - Joint Protection: Sealant for panel unit, perimeter, and control joints.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 4. ASTM C615 - Standard Specification for Granite Dimension Stone.
- B. National Building Granite Quarries Association, Inc.:
 - 1. NBGQA - Specifications for Architectural Granite.

1.3 SYSTEM DESCRIPTION

- A. Exterior wall covering system consisting of dimension stone panels anchored to backup structure with stone joints filled with sealants.
 - 1. System includes secondary weather barrier (sheathing), adhesives, fasteners, and sealants used to secure the stone to metal stud backup wall system and to produce a weather-resistant covering.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Design stone anchors and anchoring systems according to ASTM C 1242.
- B. Structural Performance: Provide dimension stone cladding system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

-
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 30 lbf/sq. ft. acting inward or outward.
 2. Equipment Loads: Allow for loads due to window cleaning and maintenance equipment.
- C. Thermal Movements: Provide dimension stone cladding system that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing displacement of stone, opening of joints, overstressing of components, failure of joint sealants, 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 , ambient; 180 deg F , material surfaces.
- D. Horizontal Building Movement (Interstory Drift): Allow for maximum horizontal building movement equal to quotient resulting from dividing floor-to-floor height at any floor by 400.
- E. Shrinkage and Creep: Allow for progressive vertical shortening of building frame equal to 1/8 inch in 10 feet (3 mm in 3 m).
- F. Safety Factors for Stone: Design dimension stone cladding system to withstand loads indicated without exceeding allowable working stress of stone determined by dividing stone's average ultimate strength, as established by testing, by the following safety factors:
1. Safety Factor: 3.
 2. Safety Factor for Concentrated Stresses: 4.
 3. Safety Factor for Anchors: 4.
- G. Design stone anchors for loads indicated without exceeding allowable working stresses established by the following:
1. For Structural Steel: AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design."
 2. For Cast-in-Place and Post installed Fasteners in Concrete: One-fourth of tested capacity when installed in concrete with compressive strength indicated.
 3. For Post-Installed Fasteners in Masonry: One-sixth of tested capacity when installed in masonry units indicated.
- H. Provisions for Fabrication and Erection Tolerances: Allow for fabrication and erection tolerances of building's structural system as specified in Section 03 3000 "Cast-in-Place Concrete".
- I. Provision for Deflection of Building Structure: Allow for the following:
1. Deflection due to Weight of Dimension Stone Cladding System: Allow for 1/4-inch vertical deflection in 20-foot span of structural members supporting dimension stone cladding system.
 2. Live Load Deflection: Allow for 3/8-inch vertical deflection, in 20-foot span of structural members supporting dimension stone cladding system, due to live loads imposed on building's structural frame after stone installation.

- J. Corrosion and Staining Prevention: Isolate metals from direct contact with other materials.

1.5 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Product Data:
 - 1. For each stone type and each manufactured product shown on Drawings or specified.
 - 2. For sealants, including test reports stating that sealants will not stain stone.
- C. Shop Drawings: Show fabrication and installation details for dimension stone cladding system, including dimensions and profiles of stone units.
 - 1. Show locations and details of joints both within dimension stone cladding system and between dimension stone cladding system and other construction.
 - 2. Show locations and details of joints.
 - 3. Show locations and details of anchors and support structure.
 - 4. Include elevations and details of decorative surfaces and inscriptions.
 - 5. Include structural analysis data signed and sealed by the qualified professional engineer.
- D. Design Data: Submit design calculations signed by an engineer registered in the State of Minnesota.
- E. Samples:
 - 1. Submit four stone samples 12 x 12 inch in size, illustrating general color range and texture, markings, surface finish, and variation.
 - 2. Anchor Samples: For each type of anchor samples.
 - 3. Sealant Samples: For each type and color of joint sealant required.
- F. Preliminary Test Reports: Submit test reports for proposed stones prior to final stone selection. Preliminary test reports shall be indicative of the stone to be proposed for the project.
 - 1. Testing of production stone may be required in addition to preliminary test reports
- G. Certification: Submit a letter of certification from the stone fabricator, stating the material being furnished is the specified material and there are sufficient reserves available to supply the project and furnish replacements if needed.
- H. Manufacturer's Installation Instructions: Submit stone fabricator's installation instructions and field erection or setting drawings. Indicate panel identifying marks and locations on setting drawings.

1.6 SUSTAINABLE DESIGN SUBMITTALS:

- A. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.

1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.7 QUALITY ASSURANCE

- A. Perform work in accordance with NBGQA Specifications for Architectural Granite.
- B. Source Limitations for Stone: Obtain stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
 1. For stone types that include same list of varieties and sources, provide same variety from same source for each.
- C. Single Source Responsibility for Stone Cladding System: Engage a qualified installer for stone cladding system to assume complete responsibility for design, fabrication, and installation of stone cladding system to comply with specified requirements.
 1. Engineering Responsibility: Comprehensive engineering analysis of exterior stone cladding by a qualified professional engineer.

1.8 QUALIFICATIONS

- A. Installer Qualifications: A firm or individual experienced in installing dimension stone cladding systems similar in material, design, and extent to that indicated for this Project, whose work has a record of successful in-service performance.
- B. Fabricator Qualifications: Engage experienced fabricator that has completed stone fabrication similar in material, design, and extent to that indicated for the project.
 1. Fabricator's responsibilities include fabricating dimension stone cladding and providing professional engineering services needed to assume engineering responsibility.
- C. Professional Engineer Qualifications: A professional engineer licensed to practice in the State of Minnesota, and experienced in providing services for stone cladding systems similar in material, design and extent to that indicated for the project.
- D. Independent Testing Qualifications: ASTM E 329.

1.9 MOCKUP

- A. Section 01 4000 - Quality Requirements: Mockup requirements.

- B. Construct stone wall mock-up, 6 feet high by 6 feet wide, including stone, stone anchor accessories, sealants, a typical corner condition, and a typical control joint. The mock-up shall become the standard for the project.
- C. Locate where directed by General Contractor.
- D. Remove mockup when directed by Architect/Engineer.

1.10 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- A. Convene minimum one week prior to commencing work of this section. The purpose of the meeting shall be to review methods and sequence of all stone work, special details and conditions, standards of workmanship, testing and quality control requirements, and other topics related to the work of this section.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Store and handle materials to prevent deterioration or damage.
 - 1. Store shall be stacked on timber or platforms at least 4 inches above the ground. Care shall be taken to prevent staining or discoloration during storage.
 - 2. If storage is to be for a prolonged period, polyethylene or other suitable plastic film shall be placed between wood and finished surfaces of completely dry stone.
 - 3. Provide ventilation to prevent condensation from forming on stone.
- C. Properly store cementitious materials. Do not use damp cementitious materials.

1.12 ENVIRONMENTAL REQUIREMENTS

- A. Protect stone as follows:
- B. During temporary storage on site, at end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.
 - 1. Prevent staining of stone from [mortar], grout, [sealants], and other sources. Immediately remove such materials without damaging stone.
 - 2. Protect base of walls using coverings spread on ground and over wall surface.
 - 3. Protect sills, ledges, and other projections from [mortar].
- C. Cold-Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.
- D. Hot-Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.13 1.10 SEQUENCING

- A. Coordinate installation of concrete or masonry inserts. Furnish setting drawings, templates, and directions for installing such items.
- B. Coordinate delivery and installation of dimension stone cladding.

1.14 MAINTENANCE

- A. Maintenance: Provide maintenance information indicating recommended cleaning and maintenance of the installed work of this section.
 - 1. Provide product data from producers of cleaning and maintenance materials and include in the maintenance manual. The manual shall include information regarding cleaning methods, stain removal methods and sealers.

PART 2 PRODUCTS

2.1 STONE MATERIAL

- A. Stone Source: Cold Spring Granite Company.
- B. Stone Material (*ST-1*):
 - 1. Granite: ASTM C615.
 - 2. Type: "Charcoal Black"
 - 3. Location: Exterior cladding.
 - 4. Surface Texture: Velvet finish.
 - 5. Nominal Thickness: 2 inches.

2.2 ANCHORS AND FASTENERS

- A. Anchor Material: Stainless steel, ASTM A666, Type 304.
- B. Dowels and Pins Material: Stainless steel, ASTM A276, Type 304.
- C. Sizes and configurations: As required for vertical and horizontal support of stone and applicable loads.
 - 1. Wire ties are not permitted.
- D. Support Components not in Contact with Stone: Stainless steel, ASTM A666, Type 304.
- E. Cast-in-Place Inserts Not In Contact with Stone: Steel or malleable iron adjustable inserts, with bolts, nuts, washers, and shims and as follows:
 - 1. Finish: Hot-dip galvanized or mechanically zinc coated
 - 2. Capacity: Sustain load equal to 4 times the required loads
 - 3. Testing: ASTM E 488.
- F. Provide stainless steel anchors including bolt, nut, flat and lock washer. Bolt designed to be inserted into routed slot in back of stone.
 - 1. Provide Type 31 Anchors manufactured by Cold Spring Granite Company.

2. Diameter: Size anchors to comply with requirements, but not less than 3/16 inch.

2.3 ACCESSORIES

- A. Setting Buttons and Shims: Plastic type.
- B. Concealed Sheet Metal Flashings: Specified in Section 07 6200.
- C. Cavity Vents and Weep Tubes: Specified in Section 04 2000.
- D. Bond Breaker: 10 mil thick plastic sheet.
- E. Sealant: Specified in Section 07 9000; color to match stone color; non-staining.
- F. Cleaning Solution: Non-acid, not harmful to stone, joint materials, or adjacent surfaces.

2.4 FABRICATION

- A. Thickness: Two inches, nominal.
- B. Panel Size: As indicated on drawings, cut square.
- C. Fabricate units for uniform coloration between adjacent units and over full area of installation.
- D. Form external corners to square joint profile.
- E. Drill holes for anchors in middle third of stone edges, spaced maximum 24 inches on center around stone perimeter.
- F. Fabricate stone to maintain minimum clearance of 1 inch between backs of stone units and surfaces behind stone.
- G. Dress joints straight and at 90 degree angle to face. Shape beds to fit supports.
- H. Anchor Provision: Cut and drill sink provisions and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone in place.
 1. Allow room for expansion of the anchoring devices where necessary.
 2. Where liners are required on the back of panels, secure by means of a mechanical anchors. Comply with referenced standards.
- I. Finish exposed faces and edges of stone, [except sawed reveals], to comply with requirements indicated for finish and to match final samples and mockups.
- J. Joint Width: Cut stone to produce uniform joints 3/8 inch.
- K. Provide chases, reveals, reglets, openings, and similar features as required to accommodate adjacent work.

- L. Grade and mark stone to achieve uniform appearance when installed. Inspect finished stone units at fabrication plant. Replace defective units.
- M. Stone Fabrication Tolerances:
 - 1. Stone thickness 2 inches or less: Plus or minus 1/16 inch of the nominal thickness.
 - 2. Stone thicknesses greater than 2 inches: Plus 1/8 inch and minus 1/16 inch of the nominal thickness.
 - 3. Stone thicknesses greater than 6 inches: Plus or minus 1/8 inch of the nominal thickness.
 - 4. Overall face size: Plus or minus 1/16 inch in both height and width
 - 5. Out of square: Plus or minus 1/16 inch difference of diagonals.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify support work and site conditions are ready to receive work of this section.
- C. Verify items built-in under other sections are properly located and sized.

3.2 PREPARATION

- A. Establish lines, levels, and coursing. Protect from disturbance.
- B. Clean interior stone prior to erection. Do not use wire brushes or implements that mark or damage exposed surfaces.

3.3 STONE CLADDING INSTALLATION

- A. Install flashings of longest practical length and seal watertight to back-up. Lap end joint minimum 6 inches and seal watertight.
- B. Erect stone in accordance with erection or setting drawings.
- C. Set stone with a consistent joint width of 3/8 inch.
- D. Obtain Architect/Engineer's approval prior to cutting or fitting item not indicated or where appearance or strength of stonework may be impaired.
- E. Install anchors and place setting buttons to support stone and to establish joint dimensions.
- F. Install weeps in vertical stone joints at 24 inches on center, horizontally; immediately above horizontal flashings, above shelf angles and supports, at bottom of walls, and as indicated on Drawings. Do not permit mortar accumulation in cavity space.

- G. Sealant: Seal joints of exterior stonework with sealant. Perform sealant work in accordance with requirements of Section 07 9000.

3.4 INSTALLATION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Variation from Plumb:
1. Vertical lines and surfaces of walls do not exceed:
 - a. 1/4 inch in 10 feet
 - b. 3/8 inch in a story height or 20 feet maximum
 - c. 1/2 inch in 40 feet or more.
 2. External corners, corners and jambs within 20 feet of an entrance, expansion joints, and other critical lines do not exceed:
 - a. 1/8 inch in 10 feet.
 - b. 1/4 inch in 20 feet.
 - c. 3/8 inch in 40 feet or more.
- C. Variation from Level:
1. Horizontal stone lines including lintels, sills, copings, bands, and grooves, not to exceed:
 - a. 1/8 inch in 10 feet.
 - b. 1/4 inch in 20 feet.
 - c. 1/2 inch in any bay
 - d. 3/4 inch in 40 feet maximum
- D. Variation of Linear Building Line:
1. Positions shown in plan and related portions of walls and partitions, do not exceed:
 - a. 1/4 inch in 20 feet.
 - b. 1/2 inch in 40 feet or more.
- E. For wall thicknesses and columns from dimensions shown, do not exceed minus 1/4 inch plus 1/2 inch.
- F. Variation in Joint Width: Do not exceed plus or minus 1/8 inch.
- G. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units.

3.5 FIELD QUALITY CONTROL

- A. The Owner will engage an independent testing laboratory to perform field quality control testing. Tests will be performed on stone cladding for water penetration in accordance with ASTM test procedures.
- B. Test results will be reported in writing by the testing laboratory to the Owner, Architect and Contractor.

3.6 ADJUSTING

- A. Remove and replace stone not matching final samples and mockups.
- B. Remove and replace stone not complying with requirements.
- C. Replace non-complying stone to match final samples and mockups, comply with specified requirements. Replacement stone shall show no evidence of replacement.
- D. Patching: Minor patching in small areas may be acceptable if the repair does not distract from the overall appearance of the finished project.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.

3.8 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean stone as work progresses. Remove mortar, sealant, and stains before tooling joints.
- C. Final Cleaning: Clean stone as recommended by fabricator or stone producer.
 - 1. Clean all finished stonework with a mild detergent using a fiber brush.
 - 2. After cleaning, rinse with clean water.
 - 3. Do not use acid or other caustic materials.
- D. When cleaning is completed, remove temporary protection

END OF SECTION

SECTION 05 1200

STRUCTURAL STEEL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel framing members and all related accessories such as structural embeds, connections, bolts, welds, fasteners, threaded rods, headed studs, including fabrication, erection and all related work and accessories.
 - 2. Prefabricated building columns.
 - 3. Framing around openings larger than 6" in roof and floor deck systems.
 - 4. Connections and other performance specified items, including related design by contractor's specialty structural engineer.
 - 5. Temporary bracing and shoring, including related design by contractor's specialty structural engineer.
 - 6. Architecturally exposed structural steel (AESS).
 - 7. Shop applied finishes and coatings, including preparation, primers, special paint systems or galvanizing on steel exposed to exterior or aggressive environments, and bitumastic coating on steel below grade in soil.
 - 8. Grouting for base plates, seats and bearing areas.
- B. Related Sections include the following:
 - 1. Division 01 Section "Structural Tests and Special Inspections" for independent testing agency procedures and administrative requirements.
 - 2. Division 03 Section "Concrete" for items attached to formwork, anchors and embeds to be cast in concrete.
 - 3. Division 04 Section "Unit Masonry" for items attached to masonry, anchors and embeds to be set in masonry.
 - 4. Division 05 Section "Steel Floor Deck" for field installation of shear connectors.
 - 5. Division 05 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
 - 6. Division 09 Section "Painting" for surface preparation and priming requirements.
 - 7. Division 09 Section "High-Performance Coatings" for surface preparation and priming requirements.
 - 8. Division 13 Section "Metal Building Systems" for requirements related to structural steel.

1.3 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. Code of Standard Practice for Buildings and Bridges.
 - 2. Manual of Steel Construction.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code - Steel.
 - 2. AWS D1.3 - Structural Welding Code – Sheet Metal.
- D. Council of American Structural Engineers of Minnesota (CASE/MN): Guideline for Special Structural Inspection and Testing.
- E. International Building Code (IBC).
- F. Minnesota State Building Code (MSBC).
- G. Research Council on Structural Connections (RCSC): Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
- H. The Society for Protective Coatings (SSPC):
 - 1. Standard Procedure for Evaluating Qualifications of Shop Painting Applicators.

1.4 DEFINITIONS

- A. Structural Steel: Elements of structural steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads, and as indicated on the structural contract documents.
- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.5 SUBMITTALS

- A. Shop Drawings and related submittals: Show complete information for fabrication and erection of structural-steel components.
 - 1. Submit shop drawings under provisions of Division 1 Section "Submittal Procedures". Phase submittals to match sequence of actual construction to avoid delay of work. Field verify all existing conditions impacting this work and add relevant field information to shop drawings, prior to submittal of shop drawings.
 - 2. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, fasteners, cambers, loads, welds, and headed studs. Cut erection details where details are cut on structural plans and add erection details as needed. Provide erection plans, erection details and member detail sheets. If partial area submittals are made, submit all related sheets and cloud related plan areas. Reference specific structural plans and details from which information is drawn or submittals will be rejected.

3. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths and weld capacities. Indicate shop and field welds and sequence of erection.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Provide setting drawings, templates and directions for the installation of the anchor rods and other anchoring devices, including embedments.

1.6 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittal: For products having recycled content indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
- B. Product Data: For each type of product indicated. Welders Certificates: Submit under provisions of Division 1 Section "Submittal Procedures". Welder's Certificates, certifying welders employed on the Work obtained appropriate AWS qualification within the previous 12 months.
- C. Certifications: Furnish certification from fire proofing manufacturer stating compatibility with shop paint primer.
- D. Qualification Data: For erector and fabricator.
- E. Mill Test Reports: Submit under provisions of Division 1 Section "Submittal Procedures". Signed by manufacturers certifying that the following products comply with requirements:
 1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Direct-tension indicators.
 4. Tension-control, high-strength bolt-nut-washer assemblies.
 5. Shear stud connectors.
 6. Shop primers.
 7. Non-shrink grout.
 8. Other structural elements as indicated on the documents.
 9. Source quality-control test reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."
- C. Comply with applicable provisions of the following specifications and documents:
 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
 3. AISC's "Specification for Structural Steel Buildings."

4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.9 FIELD MEASUREMENTS

- A. Verify actual locations of existing structure, new work previously placed and other construction to which the new work must fit by accurate field measurements before submittal of related shop drawings or fabrication. Show recorded measurements on shop drawings submitted for review. Coordinate fabrication schedule with construction progress to avoid delay of Work. Where work will be connected to existing masonry or concrete, contractor shall engage a testing agency to pre-locate hidden embeds and reinforcing steel prior to submittal of shop drawings. Provide templates and dimensions to fabricator for accurate alignment with existing conditions. Show field conditions impacting the work on the shop drawings, prior to submittal.

1.10 COORDINATION

- A. Deliver anchor rods and other anchorage devices to be embedded in concrete or masonry construction to site in time for installation without impact on schedule. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992, Grade 50.
- B. Channels, Angles, Plate and Bar: ASTM A 36.
- C. Corrosion-Resisting Structural Steel: ASTM A 588, Grade 50.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847, structural tubing.

- F. Steel Pipe: ASTM A 53, Type E or S, Grade B, Finish.
 - 1. Weight Class: As indicated on the documents.
 - 2. Finish: Black, except where indicated to be galvanized.
- G. Welding Electrodes: E70XX, comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 or ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - 3. Finish: Plain Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 4. Finish: Plain.
- B. Shear Connectors or Headed Concrete Anchors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B. The ferules shall be specifically designed for the weld-through technique.
- C. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or as indicated on Drawings.
 - 1. Configuration: Straight with nut and washer, unless specifically indicated to be hooked on the drawings.
 - 2. Nuts: ASTM A 563 heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36 carbon steel.
 - 4. Washers: ASTM F 436 hardened carbon steel.
 - 5. Finish: Plain
- D. Deformed Bar Anchors (DBA):
 - 1. Manufactures:
 - 2. Nelson Stud Welding, Inc.
 - 3. ASTM A496, uniform diameter with minimum tensile strength of 80ksi.
- E. Expansion Bolts:
 - 1. Manufactures:
 - 2. Liebig International, Ultraplus
 - 3. Hilti, Kwik-Bolts II
 - 4. ITW Ramset/Redhead, Trubolt
 - 5. Wej-it Expansion Products, Inc. Wej-it Bolts
 - 6. If embedment length is not indicated on the drawings, provide embedment length recommended by the manufacturer to develop full strength of bolt.
- F. Adhesive Anchors into Hollow Masonry:
 - 1. Manufacturers:
 - 2. Hilti, HIT HY 150
 - 3. Rods: Standard rods per ASTM A36.
 - 4. If embedment length is not indicated on the Drawings, provide embedment length recommended by manufacturer to develop full strength of bolt.

- G. Adhesive Anchors into Solid Masonry or Concrete:
 - 1. Rods:
 - 2. Standard rods per ASTM A36.
 - 3. Super rods per ASTM A193 Grade B7.
 - 4. Stainless steel rods per ASTM F593 Condition CW.
 - 5. Reinforcement bar per Section 03200.
 - 6. If embedment length is not indicated on the Drawings, provide embedment length recommended by manufacturer to develop full strength of bolt.
 - 7. Provide rods threaded full length with 45 degree bevel cut at base.
- H. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

2.3 PRIMER

- A. Primer:
 - 1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
 - 2. Color: Fabricator's standard.
- B. Galvanizing Repair Paint: ASTM A 780.
- C. Bituminous Protection Coating: Carboline, Bitumastic 50

2.4 GROUT

- A. Nonmetallic, High Strength, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. $F'c=4000$ psi minimum at 24 hours.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings" as indicated on the documents.
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Architecturally Exposed Structural Steel (AESS): Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Fabricate heavy shapes and connections (ASTM A6-Group 4 and 5 Rolled shapes) in accordance with AISC Manual of Steel Construction, Part 5, Paragraph A.3.C and related requirements for finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning or SSPC-SP 2, "Hand Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened or as indicated on Drawings.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - 4. Grind butt welds flush.
 - 5. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials.
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Painting: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than **1.5 mils**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
1. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
 2. Fill vent holes and grind smooth after galvanizing.

2.9 SOURCE QUALITY CONTROL

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

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

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify elevations of new and existing support surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements. Verify dimensions that affect the new work including gridlines, column and beam centerlines, face of wall, etc.
- B. Remove and replace existing finishes, utilities and other obstructions that may impede proper access for verification of conditions and installation of new work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

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

- C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by structural engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions. The top flanges of the beams receiving stud shear connectors shall be free of any substances that might interfere with the welding operations. During welding the steel decking panels shall be free of detrimental substances and rest tightly upon the top flange of the beam.
- J. No trades may field cut or alter structural members without specific approval of the Structural Engineer. Submit dimensioned plan and detail sketch of proposed modification under cover of an RFI or cloud proposed changes on shop drawings.
- K. Provide deck support framing typically around openings in roof and floor deck cutting more than one deck rib. Also provide support thus where openings cutting only 1 rib occur within 24" of each other in the same deck span. Typical support detail is shown on the drawings. Not all openings are shown on the structural drawings. Fabricator shall coordinate with Mechanical, Electrical, Roofing contractors and other associated trades to include all such work in base bid and determine final locations as required.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened or as indicated on Drawings.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds. Contractor shall remove all weld slag using pick and brush to expose bright steel for self-verification of workmanship by the contractor and for Quality Assurance access by testing agency. This shall be done on a daily basis as welding proceeds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 5. Grind butt welds flush.
 6. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
- C. Tension Control Devices:
1. Install using electric power wrench as recommended by bolt manufacturer.
 2. Tighten until splined end of bolt is sheared off.
- D. Expansion Bolts or Adhesive Anchors: Install according to manufactures published instructions.
- E. Shear Connectors:
1. Do not weld when the temperature is below 0 degrees F.
 2. Remove standing water in deck ribs so that water is not trapped between beams and deck during welding.
 3. Ensure that surfaces of steel beams to which studs are to be welded are dry and free of paint, dirt and debris and that deck bottom is in firm contact with beam.
 4. Install studs after steel framing and metal decking are in place.
 5. Use automatic welding equipment powered to weld studs satisfactorily under site conditions.
 6. Prior to starting each day's operations, weld at least two shear studs to determine proper generator control unit and stud welder settings.
 7. Test that studs are capable of being bent 45 degrees from vertical without weld failure.
 8. Weld additional trial shear studs at request of ITL.
 9. Minimum projection of stud above top of deck: 1-1/2 inches.

3.5 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 1, Section "Structural Tests and Special Inspections", and with IBC 2006 Chapter 17 as adopted by the 2007 MSBC, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgement of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Special Inspection and Testing Criteria

1. General
 - a. If special inspection of fabricators work is required in the shop, testing agent may test and inspect structural steel at plant before shipment. Owner and SER reserve right to reject material not complying with Contract Documents at any time before final acceptance.
2. Definitions
 - a. Refer to Division 1, Section "Structural Tests and Special Inspections" for standard requirements.
 - b. A.S.N.T.: The American Society for Non-destructive Testing
 - c. N.D.E.: Non-destructive Evaluation
 - d. A.W.S./C.A.W.I.: American Welding Society / Certified Associate Weld Inspector
 - e. A.W.S./C.W.I.: American Welding Society / Certified Weld Inspector
 - f. Special Inspector – Technical: Shall be employed by a testing agency and shall be supervised by an A.W.S./C.W.I. with a minimum of 10 years experience, or an A.S.N.T. Level III with a minimum of 10 years experience. These individuals shall satisfy the following requirements:
 - 1) Technical I: Non-destructive Testing Technician A.S.N.T.-TC-1A Level I, and/or A.W.S. Certified Associate Weld Inspector (C.A.W.I.)
 - 2) Technical II: Nondestructive Testing Technician A.S.N.T.-TC-1A Level II (NDE Technician II), A.W.S./C.A.W.I. with minimum 3 years experience, or an A.W.S./C.W.I
 - 3) Technical III: A.S.N.T. Level III with a minimum of 10 years experience or an A.W.S./C.W.I with a minimum of 10 years experience.
 - g. Special Inspector – Structural
 - 1) Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed civil/structural engineer.
 - 2) Structural II: Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the state in which the project is located. The licensed engineer shall review and approve all inspection reports.
 - 3) Special Inspector – Structural may be an employee of the SER.
3. Special Testing and Inspection Requirements
 - a. High Strength Bolting (Field Installed).
 - 1) General (Technical II)
 - a) Visually inspect mating surfaces and bolt type for all slip-critical bolted connections for general conformance with the contract documents prior to bolting.
 - b) Determine the requirements for bolts, nuts, washers, paint and installation/tightening standards are met.
 - c) Observe calibration procedures when such procedures are required in the contract documents and verify that selected procedure is used to tighten bolts.
 - 2) Slip Critical Bolts and Tension Bolts (Technical II)

- a) Test bolt tightening in 10% of all bolts. Test a minimum of two bolts in each connection. Verify that all plies of connected elements have been brought into contact, at 100% of connection. Verify all tips are removed from “twist-off” bolts.
- 3) Bearing Bolts (Technical II)
 - a) Visually inspect to conform all plies of connected elements have been brought into contact, at 100% of connections. (Applies only to bolts designed for values not requiring exclusion of threads from failure plane, all other bolts require testing as for tension bolts.)
- b. Welding (General): The Special Inspector shall perform the following (Technical II):
 - 1) Prior to start of fabrication, determine if fabrication shop meets the criteria for exempting shop welds from inspection and confirm in writing to SER.
 - 2) Verify qualifications of all welders as AWS certified.
 - 3) Verify proposed welding procedures and materials.
 - 4) Verify adequate preparation of faying surfaces.
 - 5) Verify preheat and interpass temperature of steel, proper technique and sequence of welding, and cleaning and number of passes are provided as required.
- c. Welding (Field)
 - 1) Fillet Welds (Technical II)
 - a) Visually inspect 100% of all fillet welds for size, length and quality per AWS D1.1.
 - 2) Partial Penetration Welds (Technical II)
 - a) Test 100% of all partial penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all partial penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
 - 3) Full Penetration Welds (Technical II)
 - a) Test 100% of all full penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all full penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
 - 4) Stud Shear Connector Welds (Technical I)
 - a) Visually inspect 100% of installed studs for full 360 degree flash. Test all questionable studs, not showing full 360 degree flash by bending studs 15 degrees from vertical, away from weld discontinuity, per AWS D1.1. All ceramic welding ferrules shall be removed by contractor. Randomly test all other studs by bending to 15 degrees from vertical as noted:
 - Studs welded through deck: 15%
 - Studs welded to bare steel: 5%Alternatively, sound 100% of installed studs, for full penetration weld, using an 8 lb. Maul. Test

- questionable studs as noted above. Welding ferrules need not be removed.
- 5) Deck Welds and Fasteners (Technical I)
 - a) Visually inspect size, location, length and burn through for 100% of puddle welds on metal deck designed as a structural element, per AWS D1.3.
 - b) Visually inspect sidelap fasteners to meet spacing and size specified.
 - 6) Welding of Reinforcing Bars (Technical II)
 - a) Be continuously present during welding and visually inspect 100% of all reinforcing bar welds as the welding is performed, per AWS D1.4. Verify proper joint preparation is provided and proper electrodes are used and properly store and dried.
- d. Mechanical Fasteners (Misc.)
- 1) Fasteners (Technical I)
 - a) Visually inspect specified size, spacing, embedment, and location of expansion bolts and adhesive bonded bolts in connections shown on the structural drawings.
- e. Structural Configuration
- 1) Materials (Technical I)
 - a) Verify materials delivered to site comply with contract documents and approved shop drawings. Materials include bolts, electrodes, mechanical fasteners and deck gauge.
 - 2) Detail Compatibility (Structural I) On a periodic basis:
 - a) Review project documents affecting integrity of the structure, including contract documents and pertinent submittals (approved shop drawings)
 - b) Visit site, at intervals appropriate to the stage of construction, to perform review of the structure and visually confirm general compliance with the project documents.
 - c) Inspect the following to verify member orientation, configuration, type and size comply with details indicated on the contract documents and approved shop drawings:
 - Bracing and stiffening members.
 - Proper applications of joint details at connections for structural members.
 - Other work critical to the integrity of the building structure.

3.6 REPAIRS AND PROTECTION

- A. If tests or inspections indicate Work does not meet specified requirements, remove work, replace and retest at no cost to Owner.
- B. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

- C. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05 1200

SECTION 05 2100

STEEL JOISTS

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. Long-span steel joists.
 - 2. Joist accessories.
- B. Related Requirements:
 - 1. Division 01 Section "Structural Testing and Special Inspections".
 - 2. Division 03 Section "Cast-In-Place Concrete".
 - 3. Division 04 Section "Unit Masonry": For installing bearing plates in unit masonry.
 - 4. Division 05 Section "Structural Steel".
 - 5. Division 05 Section "Steel Roof Deck".
 - 6. Division 05 Section "Steel Floor Deck".
 - 7. Division 05 Section "Metal Fabrications".
 - 8. Division 09 Section "Painting".

1.3 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings
 - 2. Code of Standard Practice for Buildings and Bridges.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. Master Painters Institute (MPI):
 - 1. MPI #18 – Primer, Zinc-Rich, Organic.
 - 2. MPI #19 – Primer, Zinc-Rich, Inorganic.
- E. Research Council on Structural Connections (RCSC): Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
- F. Steel Joist Institute (SJI): Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders.
- G. The Society for Protective Coatings (SSPC):
 - 1. SP2 – Hand Tool Cleaning.

2. SP3 – Power Tool Cleaning.
3. SP15 – Commercial Grade Power Tool Cleaning.
4. SSPC Paint 15 – Steel Joist Shop Primer/Metal Building Primer.

1.4 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists requiring modification by manufacturer to support non uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
- B. Design special joists to withstand design loads with live load deflections no greater than the following:
 1. Roof Joists:
 - a. Vertical live load deflection of 1/360 of the span.
 - b. Vertical total load deflection of 1/240 of the span.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
 1. Indicate locations and details of bearing plates to be embedded in other construction.

1.7 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittal: For products having recycled content indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
- B. Welding certificates.
- C. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.
- D. Research/Evaluation Reports: For joists.
- E. Delegated Design: Comprehensive engineering analysis of special joists indicated to comply with design loads signed and sealed by Specialty Structural Engineer responsible for its preparation.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.
- C. Installer Qualifications: Engage an experienced installer who has completed steel joist framing similar in material design, and extent to that indicated for this Project and with a record of successful in-service performance.
- D. Specialty Structural Engineer Qualifications: Employ professional Engineer, registered in Minnesota, to perform design of special joists. Sign and seal design Shop Drawings submitted to Owner for review.
- E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.10 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
- B. Steel Bearing Plates: ASTM A 36.
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain – Typical.
- D. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain – Typical.

- E. Welding Electrodes: Comply with AWS standards.
- F. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.2 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15. Color: manufacturer's standard or light gray.

2.3 LONG-SPAN STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows:
 - 1. Joist Type: LH-series steel joists.
 - 2. Top-Chord Arrangement: Parallel.
- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Camber long-span steel joists according to SJI's "Specifications."
- E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.
- C. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by commercial power-tool cleaning, SSPC-SP 15.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

- C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 or 2 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, 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 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Ensure top and bottom chords of joist are in same vertical plane.
 - 3. Do not allow top chords of joists to bow horizontally more than 1/500th of joist span.
 - 4. Space, adjust, and align joists accurately in location before permanently fastening.
 - 5. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 6. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
 - 7. Keep construction loads off of joists until they are permanently anchored and decking is installed.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing and inspecting agency to inspect field welds and bolted

connections and to perform field tests and inspections and prepare test and inspection reports.

- B. Field welds will be visually inspected according to AWS D1.1.
- C. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as applicable:
 - 1. Radiographic Testing: ASTM E 94.
 - 2. Magnetic Particle Inspection: ASTM E 709.
 - 3. Ultrasonic Testing: ASTM E 164.
 - 4. Liquid Penetrant Inspection: ASTM E 165.
- D. Bolted connections will be visually inspected.
- E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 2100

SECTION 05 3113

STEEL FLOOR DECK

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. Composite steel deck.
 2. Non-composite steel form deck.
 3. Related accessories.
- B. Related Requirements:
1. Division 01 Section "Structural Testing and Special Inspections".
 2. Division 03 Section "Cast-In-Place Concrete".
 3. Division 05 Section "Structural Steel".
 4. Division 05 Section "Steel Joists and Joist Girders".
 5. Division 07 Sections for thermal and moisture protection, and applied fireproofing.
 6. Division 09 Sections for painting and coating of exposed deck.

1.3 REFERENCES

- A. American Iron and Steel Institute (AISI):
1. North American Specification for the Design of Cold-Formed Steel Structural Members.
 2. Cold-Formed Steel Framing Standards.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
1. AWS D1.1 - Structural Welding Code - Steel.
 2. AWS D1.3 - Structural Welding Code - Sheet Metal.
- D. Steel Deck Institute (SDI): Steel Deck Institute Design Manual for Composite Decks, Form Decks, and Roof Decks - Publication No. 31.
- E. The Society for Protective Coatings (SSPC): SSPC Paint 20 - Zinc-Rich Coating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
1. Include name of deck manufacturer as well as type, depth, gauge and finish of deck.

- B. Shop Drawings:
 - 1. Show layout and types of deck panels, anchorage details, attachment patterns, field welding requirements, side lap fastenings, pans, cut deck openings, special jointing, closure plates, tabs or holes for ceiling hangers, trench headers, preset service fittings, prepunched holes for fittings, accessories, and attachments to other construction required for complete installation of decking.

1.5 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittal: For products having recycled content indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
- B. Product Certificates: For each type of steel deck, signed by product manufacturer certifying that products furnished comply with the requirements.
- C. Research/Evaluation Reports: For steel deck.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Fabricate panels to comply with dimensional parameters as defined in "Design Manual for Composite Decks, Form Decks, and Roof Decks" in SDI Publication No. 31. Section properties shall be based in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members.
- B. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 and D1.3 Structural Welding Codes.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those 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 of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

1.7 DELIVERY, STORAGE, AND HANDLING

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

- C. Keep construction loads and stored materials, including other decking, off steel deck until it is permanently fastened and inspected.
- D. Do not overload deck beyond 75 percent of rated normal capacity with stored materials or equipment.

1.8 COORDINATION

- A. Provide decking to receive spray-applied fire-resistive materials (SFRM) free of amounts of lubricant or other contaminants which would significantly impair adhesion of sprayed materials.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 COMPOSITE STEEL DECK

- A. Available Products:
 - 1. Nucor Corp.; Vulcraft Division: Type VLI.
 - 2. Wheeling Corrugating Company: Super-Bond.
- B. Fabricate panels, with integrally embossed or raised pattern ribs, and interlocking side laps to comply with dimensional parameters as defined in "Design Manual for Composite Decks, Form Decks, and Roof Decks" in SDI Publication No. 31. Section properties shall be based in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members.
- C. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 50, G60 zinc coating.
- D. Select zinc-coating weight and color, if applicable, from options in subparagraph below.
- E. Insert minimum section properties here if not indicated on Drawings.
- F. Section Properties: Deck profile, depth, design uncoated steel thickness, and finish shall be as indicated on Drawings.
- G. Span Condition: As indicated.

2.3 NONCOMPOSITE STEEL FORM DECK

- A. Available Products:
 - 1. Canam Steel Corp.
 - 2. Nucor Corp.; Vulcraft Division.
 - 3. United Steel Deck, Inc.
 - 4. Verco Manufacturing Co.
 - 5. Wheeling Corrugating Company.

- B. Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G30 zinc coating.
 - 2. Profile Depth: 9/16 inch.
 - 3. Select one steel thickness from subparagraph below or revise to suit Project.
 - 4. Design Uncoated-Steel Thickness: 0.0358 inch.
 - 5. Span Condition: As indicated.
 - 6. Side Laps: Overlapped.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

- C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

- D. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated.

- E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

- F. Galvanizing Repair Paint: ASTM A 780

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

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- F. Install piercing hanger tabs at <Insert spacing> apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

3.4 PROTECTION AND REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on bottom surface of prime-painted deck exposed to view immediately after installation, and apply repair paint of same color as adjacent shop-primed deck.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with Division 01 Section "Structural Testing and Special Inspections".
- B. Inspections:
 - 1. Visually inspect size, location, length and burn-through for 100% of puddle welds on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 2. Visually inspect size, location, and seating for 100% of powder-actuated or pneumatically driven fasteners on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 3. Report inspection results promptly and in writing to Contractor and Architect.
- C. Deck panels shall be clean, dry, and in firm contact with substrate prior to welding.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 05 3113

SECTION 05 3123

STEEL ROOF DECK

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. Roof deck.
- B. Related Requirements:
 - 1. Division 01 Section Structural Testing and Special Inspections.
 - 2. Division 05 Section Structural Steel.
 - 3. Division 05 Section Steel Joists and Joist Girders.
 - 4. Division 07 Sections for thermal and moisture protection, and applied fireproofing.
 - 5. Division 09 Sections for painting and coating of exposed deck.

1.3 REFERENCES

- A. American Iron and Steel Institute (AISI):
 - 1. North American Specification for the Design of Cold-Formed Steel Structural Members.
 - 2. Cold-Formed Steel Framing Standards.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code - Steel.
 - 2. AWS D1.3 - Structural Welding Code - Sheet Metal.
- D. Factory Mutual Global (FMG): Approval Guide, Building Materials.
- E. International Code Council - Evaluation Service (ICC-ES): Evaluation Reports.
- F. Steel Deck Institute (SDI): Steel Deck Institute Design Manual for Composite Decks, Form Decks, and Roof Decks - Publication No. 31.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
 - 1. Include name of deck manufacturer as well as type, depth, gauge and finish of deck.

- B. Shop Drawings:
 - 1. Show layout and types of deck panels, anchorage details, attachment patterns, field welding requirements, side lap fastenings, pans, cut deck openings, special jointing, accessories, and attachments to other construction required for complete installation of decking.
 - 2. Include deck manufacturer's ICC-ES Evaluation Report Number.

1.5 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Product Certificates: For each type of steel deck, signed by product manufacturer.
 - 2. Welding certificates signed by contractor certifying that welders comply with requirements of Article 1.4 Quality Assurance.
- B. Sustainable Design Submittal: For products having recycled content indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Fabricate panels to comply with dimensional parameters as defined in Design Manual for Composite Decks, Form Decks, and Roof Decks in SDI Publication No. 31. Section properties shall be based in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members.
- B. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 and D1.3 Structural Welding Codes.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.
- C. Keep construction loads and stored materials, including other decking, off steel deck until it is permanently fastened and inspected.
- D. Do not overload deck beyond 75% rated capacity with stored materials or equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Canam Steel Corp.
 2. Epic Metals Corporation.
 3. Nucor Corp.; Vulcraft Division.
 4. United Steel Deck, Inc.
 5. Verco Manufacturing Co.
 6. Wheeling Corrugating Company.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 2. Deck Profile: As indicated on Drawings.
 3. Profile Depth: As indicated on Drawings.
 4. Design Uncoated-Steel Thickness: As indicated on Drawings
 5. Span Condition: As indicated on Drawings.
 6. Side Laps: Overlapped.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, of same thickness, material and finish as deck; of profile indicated or required for application.
- D. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick (14-ga), of same material and finish as deck. For drains, cut holes in the field.
- E. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.
- F. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck at contractor's option. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Space welds as indicated on Drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or as indicated on Drawings, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 8 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

3.4 PROTECTION AND REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on top surface of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- D. No hangers, fasteners or loads shall be hung from the underside of the deck unless specifically indicated thus on the structural drawings. Such items as mechanical/electrical equipment, utility lines, architectural bulkheads, ceilings, signage, etc, shall have their own sub-framing designed, supplied and installed by their related trade, as required span to adjacent beams, joists or walls for any support needed.

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with Division 01 Section Structural Testing and Special Inspections.
- B. Inspections:
 - 1. Visually inspect size, location, length and burn-through for 100% of puddle welds on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 2. Visually inspect size, location, and seating for 100% of powder-actuated or pneumatically driven fasteners on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 3. Report inspection results promptly and in writing to Contractor and Architect.
- C. Inspection Procedure:

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1. After five to ten squares of roof deck have been erected, arrange for inspection agency to visually inspect fastening system for size, quality and spacing at interior supporting members, perimeter supports and side laps.
 2. Demonstrate corrective procedures for deficiencies found by inspection agency to satisfaction of the Architect and inspection agency before erection of roof deck is resumed.
 3. Use approved fastening system, including corrective procedures, as standard for comparison for remaining deck fastening.
 4. When erection of roof deck is completed, but before placing roofing materials, arrange for inspection agency to make inspection of complete deck installation and submit written report to Architect.
- D. Deck panels shall be clean, dry, and in firm contact with substrate prior to welding.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 05 3123

SECTION 05 4000

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
1. Load bearing formed steel stud exterior and interior wall framing.
 2. Formed steel framing and bridging.
 3. Exterior Sheathing.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 04 2000 - Unit Masonry Assemblies: Veneer masonry supported by wall.
 3. Section 04 4200 – Exterior Stone Cladding: Veneer stone supported by wall.
 4. Section 05 1200 - Structural Steel Framing: Structural building framing.
 5. Section 06 1053 - Miscellaneous Rough Carpentry: Rough wood blocking.
 6. Section 07 2119 – Foamed-In-Place Insulation: Insulation within framing members.
 7. Section 07 2600 - Vapor Retarders: Spray-on membrane.
 8. Section 09 2116 - Gypsum Board Assemblies: Light weight, non-load bearing metal stud framing.

1.2 REFERENCES

- A. American Iron and Steel Institute:
1. AISI - Residential Steel Framing Manual.
 2. AISI SG-973 - Cold-Formed Steel Design Manual.
- B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 2. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 3. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.
 4. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 5. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 6. ASTM C954-07 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

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7. ASTM C955-08a - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
 8. ASTM C1007-08 – Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
- C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.
 2. AWS D1.3 - Structural Welding Code - Sheet Steel.
- D. National Association of Architectural Metal Manufacturers:
1. NAAMM ML/SFA 540 - Lightweight Steel Framing Systems Manual.
- E. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Paint.
 2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
- F. Steel Stud Manufacturers Association:
1. SSMA - Product Technical Information.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
- B. Size exterior wall framing components to withstand design loads as follows:
1. Wind loads: As indicated on Structural Drawings
- C. Maximum Allowable Deflection: Design framing systems to withstand design loads without deflections greater than the following:
1. L/360 for interior wall systems.
 2. L/600 for exterior wall systems supporting masonry or stone cladding.
 3. L/360 for exterior wall systems supporting other cladding materials.
- D. Wall Systems:
1. Design to AISI SG-9736 Cold-Formed Steel Design Manual.
 2. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 3. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- E. Interior wall framing: Select stud thickness and spacing to resist minimum 5 psf uniform load and maximum allowable deflection.

1.4 ACTION SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings:
1. Provide Shop Drawings prepared by cold-formed metal framing manufacturer.

2. Drawings shall indicate materials, shop coatings, steel thickness, component details, framed openings, bearing, anchorage details, loading, welds, and accessories or items required for related Work. Drawings shall include plans, elevations, sections and details.
 3. Indicate stud layout.
 4. Describe methods for securing studs or joists to tracks, and for bolted or welded framing connections.
- C. Product Data: Submit data on standard framing members; describe materials and finish, product criteria, and limitations.
- D. Manufacturer's Installation Instructions: Submit procedures for any conditions requiring special attention.

1.5 INFORMATIONAL SUBMITTALS

- A. Design Calculations: Submit calculations and related details prepared, sealed, and signed by registered design professional licensed to practice structural engineering in the State of Minnesota.
1. Include calculations and details for loadings and stresses for all exterior wall and soffit systems under provisions of Section 01 3300.
 2. Indicate locations, sizes, spacings, gages, fastenings, and reinforcing. Design wind loads are indicated on Structural Drawings. Maximum deflection: As noted in Performance Requirements.
 3. Bidder is responsible for calculating loading requirements and satisfying standards established by Structural Drawings.
- B. Certifications: Submit manufacturers' certification that materials delivered to the site conform to the requirements of this section and the Drawings.
1. Certify the steel bare metal thickness in 0.001 inches; yield strength, tensile strength, total elongation in 2 inch or 8 inch gauge length, chemical analysis, and galvanized coating thickness.
- C. Sustainable Design Submittal: For products having recycled content indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

1.6 QUALITY ASSURANCE

- A. Calculate structural properties of framing members in accordance with AISI SG-973 North American Specification for Design of Cold-Formed Steel Structural Members.
- B. Furnish framing materials in accordance with SSMA - Product Technical Information.

1.7 QUALIFICATIONS

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
1. Any member, in good standing, of Steel Stud Manufacturers Association.

- B. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience and approved by manufacturer.
- C. Structural Engineer Qualifications: Professional Engineer experienced in design of this Work and licensed to practice structural engineering in the State of Minnesota.

1.8 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

PART 2 PRODUCTS

2.1 COLD-FORMED METAL FRAMING

- A. Manufacturers:
 - 1. Custom Stud Inc.
 - 2. ClarkDietrich Building Systems.
 - 3. Marino\Ware.
 - 4. The Steel Network.
 - 5. Dale/Incor.

2.2 FRAMING COMPONENTS

- A. Steel Sheet: ASTM A1003/A1003M; Structural Grade, Type H, metallic coated:
 - 1. Grade: As required by performance requirements.
 - 2. Protective Coating: In accordance with ASTM C955, Table 1, CP 60 minimum, only the following coatings are acceptable:
 - a. G60 – Hot-dipped Galvanized.
 - b. A60 – Hot-dipped Galvannealed coated.
 - c. AZ50 – 55% Aluminum-zinc allow coated.
 - d. GF – Zinc – 5% Aluminum allow coated.
 - 3. Primer: FS TT-P-645, touch-up for galvanized surfaces.
- B. Studs: Steel sheet, formed to channel shape, punched web;
 - 1. Exterior stud framing: minimum 18 gage thick, minimum.
- C. Track: Steel sheet, formed to channel shape; same width as studs, tight fit; 16 gage, minimum; solid web. Provide deep leg sections where vertical movement between top of stud wall and structure is required.
- D. Slotted Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track: punched with vertical slots in both legs.

2.3 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined by performance requirements specified.
- B. Plates, Gussets, Clips: Formed sheet steel, thickness determined by performance requirements specified.

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- C. Touch-Up Paint: ASTM A780; galvanizing repair paint.

2.4 FASTENERS

- A. Self-drilling, Self-tapping Screws, Bolts, Nuts, and Washers: Steel, hot dip galvanized.
- B. Anchorage Devices: Power driven or power actuated drilled expansion bolts; or screws with sleeves.
- C. Welding: In conformance with AWS D1.1 and AWS D1.3.

2.5 EXTERIOR SHEATHING

- A. Exterior Gypsum Sheathing:
1. Fiberglass-mat faced gypsum sheathing manufactured in accordance with ASTM C 1177 and, when tested for mold and mildew resistance in accordance with ASTM D 3273, achieves a score of 10.
 2. Sheathing shall have glass mats on face, back and long edges, mold and water-resistant treated core and shall be in thickness as shown on Drawings.
 - a. Width: 4'-0".
 - b. Length: 8'-0", 9'-0" or 10'-0" sheets.
 - c. Edges: Square.
 - d. R-Value (ASTM C518): Minimum 0.56.
 - e. Microbial Resistance (ASTM D6329, GREENGUARD 3-week protocol): Will not support microbial growth.
- B. Acceptable products include the following:
1. CertainTeed: GlasRoc Sheathing.
 2. Georgia Pacific: Dens-Glass Gold.
 3. National Gypsum: Gold Bond e2XP Sheathing .
 4. United States Gypsum Company: Securock Glass-Mat Sheathing.
 5. Substitutions: Under provisions of Section 01 6000.
- C. Fire resistance:
1. Noncombustible when tested in accordance with ASTM E 136.
 2. 1/2" or 5/8" Exterior Sheathing: Flame spread 10, smoke developed 0, when tested in accordance with ASTM E 84.
 3. 5/8" Type X Exterior Sheathing: as defined in ASTM C 1396.
- D. Sheathing Accessories:
1. Joint tape: 2" wide 10x10 glass mesh tape.
 2. Joint compound: Setting-type joint compound as recommended by manufacturer.
 3. Screws: ASTM C1002, corrosion resistant treated.

2.6 FABRICATION

- A. Galvanize, touch-up, and prime paint metal materials used on exterior wall and soffit framing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and building framing components are ready to receive Work.
- C. Verify rough-in utilities are in proper location.

3.2 ERECTION OF STUDS

- A. Align floor and ceiling tracks; locate according to wall and partition layout. Secure in place with fasteners or welding at maximum 24 inches oc. Coordinate installation of acoustic sealant with floor and ceiling tracks.
- B. Place studs at 16 inches oc maximum or as required by design; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clips and ties, screws, or welding, in accordance with manufacturer's instructions.
- C. Construct corners using minimum three studs. Install double studs at openings. Install intermediate studs above and below openings to match stud spacing.
- D. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- E. Erect load-bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
- F. Fully seat axial loaded studs in receiving tracks (maximum 1/16 inch gap between stud and track web).
- G. Coordinate placement of insulation in multiple stud spaces after erection.
- H. Install studs with deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- I. Attach cross studs or furring channels to studs for attachment of fixtures anchored to walls.
- J. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- K. Touch-up field welds and damaged metallic coatings surfaces with primer to match shop coating.
- L. Complete framing ready to receive exterior wall masonry and stone finishes.

3.3 EXTERIOR SHEATHING

- A. Provide exterior sheathing where indicated on Drawings.

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- B. Examine sub framing to verify that surface of framing and furring members to receive sheathing does not vary more than 1/8" from the placement of faces of adjacent members.
 - C. Materials may be stored outdoors for up to one month if stacked off the ground under protective covering.
 - D. Attach sheathing to metal framing per manufacturer's recommendations. Use maximum lengths possible to minimize number of joints.
 - E. Following installation on metal framing system, leave sheathing exposed to the elements no longer than one month before covering with finishing materials or protective covering.
 - 1. Provide sheathing manufacturer's warranty covering in- place weather exposure damage if sheathing is to be left exposed to the elements for more than one month.
 - F. Provide joint treatment in accordance with sheathing manufacturer's instructions.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation from Indicated Position: 1/8 inch.
- C. Maximum Variation of Members from Plane: 1/8 inch in 10 feet

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop fabricated steel, aluminum and stainless steel items: Refer to Schedule at end of this Section.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
 - 3. Section 03 4100: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in precast concrete.
 - 4. Section 04 2000 - Unit Masonry: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in masonry.
 - 5. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
 - 6. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
 - 7. Section 05 3113 - Steel Floor Decking: Bearing plates, angles, and tubing for metal deck bearing, including anchorage.
 - 8. Section 05 5100 - Metal Stairs.
 - 9. Section 05 5200 - Metal Pipe Railings.
 - 10. Section 05 7000 – Decorative Metal Fabrications
 - 11. Section 09 9000 - Painting and Coating: Field applied paint finish.

1.2 REFERENCES

- A. Aluminum Association:
 - 1. AA DAF-45 - Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association:
 - 1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- C. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
6. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
7. ASTM A297/A297M - Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application.
8. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
10. ASTM A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
11. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
12. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
13. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
14. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
15. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
16. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
17. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
18. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings.
19. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings.
20. ASTM B177 - Standard Guide for Chromium Electroplating on Steel for Engineering Use.
21. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
22. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
23. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
24. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
25. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
26. ASTM F436 - Standard Specification for Hardened Steel Washers.
27. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

D. American Welding Society:

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D1.6 - Structural Welding Code - Stainless Steel.

- E. National Ornamental & Miscellaneous Metals Association:
 - 1. NOMMA Guideline 1 - Joint Finishes.
- F. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.
 - 2. SSPC SP 1 - Solvent Cleaning.
 - 3. SSPC SP 10 - Near-White Blast Cleaning.
 - 4. SSPC Paint 15 - Steel Joist Shop Paint.
 - 5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
- G. OSHA: Occupational Safety and Health Administration
 - 1. OSHA 1910.27 – Requirements for Fixed Ladders.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Product data: Provide data on all cleaning, galvanizing, and finishing products, including VOC content where applicable.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Verify field conditions and dimensions.
 - 2. Receive and comply with reviewed shop drawings prior to fabrication.
 - 3. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.
- D. Samples: Submit three 6 x 6 inch in size illustrating factory finishes.
- E. Design Calculations: Submit calculations and related details prepared, sealed, and signed by registered design professional licensed to practice structural engineering in the State of Minnesota.
 - 1. Include calculations and details for loadings and stresses for all metal fabrications under provisions of Section 01 3300.
 - 2. Indicate locations, sizes, welding, fasteners, and reinforcing. Unless noted otherwise on Structural Drawings, design loads shall be as prescribed under applicable building code.
- F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

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3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials : For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Paints and Coatings : Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 QUALITY ASSURANCE

- A. Finish joints in accordance with NOMMA Guideline 1.

1.6 QUALIFICATIONS

- A. Structural Engineer: Professional Engineer experienced in design of this Work and licensed to practice structural engineering in the State of Minnesota.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Accept metal fabrications on site in labeled shipments. Inspect for damage.
- C. Protect metal fabrications from damage by exposure to weather.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Plate: ASTM A36/A36M.
- C. Hollow Structural Sections: ASTM A500, Grade B.
- D. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40.
- E. Sheet Steel: ASTM A653/A653M, Grade 33 Structural Quality with galvanized coating.
- F. Bolts: ASTM A307; Grade A or B. or ASTM A325; Type 1
 - 1. Finish: Unfinished. Hot dipped galvanized, where noted.
- G. Nuts: ASTM A563 heavy hex type.
 - 1. Finish: Unfinished. Hot dipped galvanized, where noted.
- H. Washers: ASTM F436; Type 1.
 - 1. Finish: Unfinished. Hot dipped galvanized, where noted.
- I. Welding Materials: AWS D1.1; type required for materials being welded.
- J. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
- K. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic.

2.2 MATERIALS - STAINLESS STEEL

- A. Bars and Shapes: ASTM A276; Type 304.
- B. Pipe: ASTM A312/A312M, seamless; Type 304.
- C. Plate, Sheet and Strip: ASTM A167, Type 304.
- D. Bolts, Nuts, and Washers: ASTM A354.
- E. Welding Materials: AWS D1.6; type required for materials being welded.

2.3 MATERIALS - ALUMINUM

- A. Sheet Aluminum: ASTM B209, 3003 or 5005 alloy, H15, H16, or H34 temper.
- B. Bolts, Nuts, and Washers: Stainless steel.
- C. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 GRATING

- A. Manufacturers:
 - 1. All American Grating.
 - 2. Amico .
 - 3. McNichols Company
 - 4. Substitutions: Section 01 6000 - Product Requirements.
- B. Elevator platform grating (Elevator No.2): Refer to structural drawings for sizing. Maximum opening between grating bars is 20 mm (0.8”).
- C. Carbon steel welded bar grating of shapes indicated on drawings. Hot dip galvanized finish.
- D. Welding Materials: Type required for materials being welded.

2.5 STAINLESS STEEL PIT COVERS

- A. Provide stainless steel plate flooring to cover lab pits in room B-156 and B-102.
 - 1. Basis of design
 - 2. Metal plate with raised pattern for slip resistance; Type 304, mill finish.
 - 3. Plate width minimum 48 inches by length of pit span in shortest direction.
 - 4. Thickness as required for span and support of a live load of 125 psf.
 - 5. Provide all substructure required for support of the flooring span over the pit, including anchorage to concrete pit walls.

2.6 LINTELS

- A. Lintels: Steel sections, size and configuration as indicated on Drawings, length to allow 8 inches minimum bearing on both sides of opening.
 - 1. Exterior Locations: Galvanized.
 - 2. Interior Locations: Prime paint, one coat.

2.7 ELEVATOR SILL ANGLES AND HOIST AND DIVIDER BEAMS

- A. Sill Angles: Steel sections as indicated on Drawings for support of elevator sills, prime paint, one coat.
- B. Hoist and Divider Beams: As indicated on Drawings, prime paint, one coat.

2.8 OVERHEAD DOOR FRAMES

- A. Overhead Door Frames: Steel channel, angles and bent plate sections, size indicated on Drawings, with jamb anchors suitable for building into masonry and precast concrete, minimum 4 anchors per jamb, galvanized.

2.9 BOLLARDS

- A. Bollards: Steel pipe, concrete filled, crowned cap, 6 inches diameter, length as indicated on Drawings; galvanized.

- B. Concrete Fill: 3,000 psi as specified in Section 03 3000.
- C. Anchors: Concealed type as indicated on Drawings.

2.10 LADDERS

- A. Elevator Pit Ladder: By Division 14.
- B. Exterior Vertical Roof Ladder: Basis of Design: O'Keefe prefabricated ladder.
 - 1. Refer to Drawings for location and general layout.
 - 2. Aluminum construction. Refer to Drawings for location and general layout:
 - 3. Rungs: 24 inches wide, constructed from square tubular aluminum extrusions not less than 1-1/4 inches in section squared and deeply serrated on all sides.
 - a. Rung spacing not more than 12 inches o.c.
 - b. Rungs shall withstand a 1,000-pound load without deformation or failure.
 - 4. Heavy Duty Tubular Side Rails: Aluminum extrusions no less than 1/8 inch wall thickness by 3 inches wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.
 - 5. Handrails shall be aluminum pipe, not less than 1-1/2 inches
 - 6. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
 - 7. Landing Platform: 1-1/2 inches or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.
 - 8. Finish: Urethane paint over chemically pretreated substrate. Color to be dark gray.

2.11 STAIR NOSINGS

- A. Manufacturers - Cast Metal:
 - 1. Wooster Products Inc.
 - 2. Safe T Metal Company.
 - 3. American Safety Tread Co. Inc.
 - 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Stair Nosings: Cast iron with integral abrasive grit of aluminum oxide or silicon carbide; 2 inches wide x lengths required to accurately fit each opening or condition. Provide integral anchors for casting into concrete.

2.12 UNISTRUT

- A. Lab Pit Walls: Provide non-ferrous stainless steel alloy channel and connecting hardware. Unistrut to be flush embedded into cast in place concrete wall.
 - 1. Refer to drawings for spacing and lengths.
 - 2. Provide P1000 profile in stainless steel.
- B. Student Machine Shop (B-168): Provide zinc channel and connecting hardware for surface mounting to concrete masonry and cast-in-place concrete walls.
 - 1. Refer to drawings for spacing and lengths.
 - 2. Provide P3300 profile in electroplated zinc, Type III SC-1.

2.13 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.14 GRATING FABRICATION

- A. Fabricate grates and plates to accommodate design loads.
- B. Weld joints of intersecting metal sections.
- C. Fabricate support framing for openings.
- D. Top Surface: Non-slip.
- E. Removable Panels: With recessed handles.

2.15 FACTORY APPLIED FINISHES - STEEL

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with one coat except where galvanizing is specified.
- D. Galvanizing: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.
- E. Galvanizing for Fasteners, Connectors, and Anchors:
 - 1. Hot-Dipped Galvanizing: ASTM A153/A153M.
 - 2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.16 FACTORY APPLIED FINISHES - STAINLESS STEEL

- A. Satin Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.

2.17 FACTORY APPLIED FINISHES - ALUMINUM

- A. Painted Aluminum Surfaces: AA-M12C12R1x non-specular as fabricated mechanical finish, chemically cleaned, and prepared for applied coating; with organic coating.
 - 1. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605 minimum three coat, with minimum 70 percent polyvinylidene fluoride resin.
 - 2. Color: To match aluminum-framed storefronts.
- B. Interior Aluminum Surfaces: Clear Anodized Aluminum Surfaces: AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils clear anodized coating.
 - 1. Conform to AAMA 611.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.18 FABRICATION TOLERANCES

- A. Squareness: 1/8-inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal and aluminum where site welding is required.
- B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.

- B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.
- C. Field weld components indicated on Drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.
- F. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.4 INSTALLATION – GRATING

- A. Place frames in correct position, plumb and level.
- B. Mechanically cut galvanized finish surfaces. Do not flame cut.
- C. Anchor by welding through saddle clips .
- D. Set perimeter closure flush with top of grating and surrounding construction.
- E. Secure to prevent movement.

3.5 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- C. Maximum Offset From Alignment: 1/4 inch.
- D. Maximum Out-of-Position: 1/4 inch.

3.6 SCHEDULE

- A. Provide and install items listed in Schedule and shown on Drawings with anchorage and attachments necessary for installation.
- B. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
 - 1. Steel Lintels; galvanized.
 - 2. Steel ledge and shelf angles.
 - 3. Steel elevator sill angles, hoist beams and guide rail supports; prime paint finish.
 - 4. Grating at elevator platform; galvanized finish.
 - 5. Steel masonry relieving angles; prime paint (over hot-dipped galvanized finish) for field finish.
 - 6. Steel overhead door opening frames; prime paint (over hot-dipped galvanized finish) for field finish.

7. Steel bollards; prime paint (over hot-dipped galvanized finish) for field finish.
8. Ladders; aluminum; factory finished.
9. Steel angle framing for mechanical duct penetrations in concrete floor; prime paint finish.
10. Bent plate sections and angles for support of countertops and other casework items. Prime and paint per Section 09 9000.
11. Structural supports for miscellaneous attachments.
12. Steel angle framing for aluminum and glass entry doors; prime paint finish.
13. Miscellaneous bent steel clip angles and steel plates; prime paint finish.
14. Steel angle framing for windows; galvanized finish.
15. Stainless steel lab pit covers where noted on plans. (remainder are fiberglass)
16. Non-ferrous, cast-in concrete unistrut at pit walls.
17. Surface mounted Unistrut at Machine Shop walls.
18. "Gage metal" steel sheet used as closures and plates. Assume 12 ga thick, unless noted otherwise.
19. Restraint chains at roof access into Stair 2 on east side. One side fixed, the other hooked to wall eyelet.
20. Restraint chain at alcove north of Stair 2 on basement level. One side fixed, the other hooked to wall eyelet.

END OF SECTION

SECTION 05 5100

METAL STAIRS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes;
 - 1. This section applies to all stairs except for Stair No. 3 in Lobby.
 - 2. Shop fabricated steel stair frame of structural sections, with closed risers and pan to receive concrete fill stair treads and landings.
 - 3. Steel pipe handrails and railing systems integral to metal stairs.
 - 4. Steel pipe handrails attached to walls adjacent to metal stairs.
 - 5. Steel stair structural design and engineering.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 - Cast-In-Place Concrete: Execution requirements for placement of metal anchors specified in this section in concrete.
 - 3. Section 03 3000 - Cast-In-Place Concrete: Concrete fill in stair pans and landings; reinforcement for landings.
 - 4. Section 04 2000 - Unit Masonry: Execution requirements for placement of metal anchors specified in this section in masonry.
 - 5. Section 05 5000 - Metal Fabrications.
 - 6. Section 05 5200 - Metal Pipe Railings: Pipe handrails and guardrails other than specified in this section.
 - 7. Section 05 7000 - Decorative Metal Fabrications: Stair No. 3 in Lobby.
 - 8. Section 09 9000 - Painting and Coating: Paint finish.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

- B. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 5. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 6. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 7. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

8. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 9. ASTM A501. - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 10. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
 11. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 12. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 13. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 14. ASTM F436 - Standard Specification for Hardened Steel Washers.
 15. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
 16. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
 17. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 2. AWS D1.1 - Structural Welding Code - Steel.
- D. National Association of Architectural Metal Manufacturers:
1. NAAMM AMP 510 - Metal Stairs Manual.
 2. NAAMM MBG 531 - Metal Bar Grating Manual.
- E. National Ornamental & Miscellaneous Metals Association:
1. NOMMA Guideline 1 - Joint Finishes.
- F. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
 2. SSPC SP 1 - Solvent Cleaning.
 3. SSPC SP 10 - Near-White Blast Cleaning.
 4. SSPC Paint 15 - Steel Joist Shop Paint.
 5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 DESIGN REQUIREMENTS

- A. Structural Performance: Engineer, fabricate and install steel stairs, handrails, and railing systems to accommodate code required loads as well as the specified structural loads, without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of steel stairs.
1. Fabricate stair assembly to support a minimum uniform live load of 100 lb/sq ft of projected plan area or an alternative concentrated load of 300 lb/sq ft applied at the center of any tread span, with deflection of stringer or landing framing not to exceed 1/240 of span.
 2. Design railing assembly, wall rails, and attachments to withstand 50 pounds per foot or a nonconcurrent concentrated force of 200 lbs applied in any

direction at any point on the handrail and top rail. Design guardrail panels and/or pickets for a uniform load of 25 pounds per square foot, nonconcurrent with rail loads.

- B. Fabricate stair assembly to meet requirements of NAAMM AMP 510, Class Commercial.
- C. Stair assembly shall be fabricated to meet all local and ADA code requirements for handicapped accessibility.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate plans, profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, fabrication and accessories.
- C. Shop Drawings: Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- D. Design Data: Submit calculations with material properties, and other information for systems that have loading requirements. Structural calculations shall be certified by a specialty structural engineer licensed in the State of Minnesota.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM E985 - Permanent Metal Railing Systems and Rails for Buildings.
- B. Finish joints in accordance with NOMMA Guideline 1.

1.6 QUALIFICATIONS

- A. Structural Engineer Qualifications: Professional Engineer experienced in design of this Work and licensed to practice structural engineering in the State of Minnesota.
- B. Fabricator/Installer Qualifications: Firm with five years documented experience in producing and installing steel stairs similar to those indicated for this project and with sufficient production capacity to produce required units without delaying The Work.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements on site prior to fabrication.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. General: For surfaces exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, roughness, or, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- B. Steel Sections: ASTM A36/A36M.
- C. Steel Plate: ASTM A36/A36M.
- D. Hollow Structural Sections: ASTM A500, Grade B. Where indicated, provide tubing with hot-dipped galvanized coating per ASTM A53.
- E. Steel Pipe: ASTM A53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads. Black finish, unless otherwise indicated.
- F. Sheet Steel: ASTM A653/A653M, galvanized where noted.
- G. Tread and Landing Concrete Reinforcement: Mesh type, unfinished.
- H. Fasteners:
 - 1. Bolts and Nuts: hexagon-head type, ASTM A307 or ASTM A325 as required, Grade A; with hex nuts, ASTM A563, and where needed, flat washers.
 - 2. Lag Bolts: ANSI B18.2.1 (B18.2.3.8M).
 - 3. Expansion Anchors: Anchor bolt and sleeve assemblies with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488.
 - 4. Provide plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls.
- I. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- J. Welding Materials: AWS D1.1; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic or Type II Organic zinc rich.
- M. Stair Railing Infill Panels:
 - 1. Per the Drawings.
- N. Stair Treads: Concrete in metal pan; light broom finish surface. Refer to drawings for dimensions and layout.

-
- O. Concrete: Type specified in Section 03 3000.

2.2 FABRICATION

- A. Fit and shop assemble components in largest practical sections, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Continuously seal joined pieces by continuous welds.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible.
- E. At exposed welded connections, grind exposed welds smooth and flush so welded surface matches adjoining surfaces. Ease exposed edges to a radius of approximately 1/32 inch. Form bent-metal corners to smallest radius possible without impairing work.
- F. At exposed mechanical fastenings, countersink screws or bolts shall be flush, unobtrusively located and consistent with design of component, except where specifically noted otherwise.
- G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- H. Accurately form components required for anchorage of stairs, landings and railings to each other and to building structure.

2.3 FABRICATION - PAN STAIRS AND LANDINGS

- A. Fabricate stairs and landings with closed risers and treads of metal pan construction, ready to receive concrete.
- B. Form treads and risers with minimum 14-gage sheet steel stock.
- C. Secure reinforced tread pans to stringers with clip angles; welded in place.
- D. Form stringers with rolled steel channels, 12 inches deep, unless noted otherwise on the Drawings.
- E. Form landings with minimum 14 gage sheet stock. Reinforce underside with metal T's or angles to attain design load requirements.
- F. Form railings with steel sections, welded to stringers. Refer to Drawings for size, detail and design layout of railings.

2.4 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

- B. Apply shop primer to uncoated surfaces except those with a galvanized finish or those to be in direct contact bond with concrete, sprayed-on fireproofing, or masonry, or where field welding is required.
- C. Prime paint items with one coat.
- D. Provide galvanized finish at loading dock stair only (Room 1-166).
 - 1. Galvanizing: ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.
- E. Galvanizing for Fasteners, Connectors, and Anchors:
 - 1. Hot-Dipped Galvanizing: ASTM A153/A153M.
 - 2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive work.
- C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall-mounted handrails.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates. Provide anchorage devices where necessary for securing steel stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts and other connectors as required.

3.3 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Perform cutting, fitting, and drilling required for installing steel stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true and free of rack.
- C. Install anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
- D. Allow for erection loads. Install sufficient temporary bracing to maintain framing safe, plumb, and in alignment.
- E. Field weld components indicated on shop drawings. Perform field welding in accordance with AWS D1.1.

- F. Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- G. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- H. Obtain approval of Architect/Engineer prior to site cutting or creating adjustments not scheduled.
- I. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- J. For galvanized surfaces, clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- C. Maximum Offset From Alignment: 1/4 inch.
- D. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 5200

METAL PIPE RAILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes;
 - 1. Steel pipe guardrail at High Bay Mezzanine
 - 2. Miscellaneous pipe guardrails.
 - 3. Pipe railings at ramps.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 - Cast-In-Place Concrete: Execution requirements for placement of anchors specified in this section in concrete.
 - 3. Section 05 5100 - Metal Stairs: Handrails at stairs other than those specified in this section.
 - 4. Section 05 7000 – Decorative Metal Railings: Guardrail at Second Floor and Stair No. 3.
 - 5. Section 09 9000 - Painting and Coating: Paint finish.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 3. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - 4. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
 - 5. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

- B. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.
 - 2. SSPC Paint 15 - Steel Joist Shop Paint.
 - 3. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 DESIGN REQUIREMENTS

- A. Design railing assembly and attachments to withstand 50 pounds per foot or a nonconcurrent concentrated force of 200 lbs applied in any direction at any point on the handrail and top rail. Design guardrail panels and/or pickets for a uniform load of 25 pounds per square foot, nonconcurrent with rail loads.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Design Data: Submit calculations with material properties, and other information for systems that have loading requirements. Structural calculations shall be certified by a specialty structural engineer licensed in the State of Minnesota. Submit design calculations for record purposes.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.6 QUALITY ASSURANCE

- A. Finish joints in accordance with NOMMA Guideline 1.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 RAILING SYSTEM COMPONENTS

- A. Refer to Drawings for railing components at each location.
- B. Pipe: ASTM A53/A53M, Grade B, Schedule 40.
- C. Channels, Angles, Plate and Bar: ASTM A 36.
- D. Fittings: Elbows, T-shapes, wall brackets, escutcheons; [cast] [machined] steel.
- E. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- F. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.

2.2 ACCESSORIES

- A. Sealant: As specified in Section 07 9000.
- B. Backing Paint: Protective Backing Paint: Zinc molybdate alkyd.
- C. Sleeves: ASTM A53/A53M, Schedule 40, galvanized steel pipe where noted.
- D. Escutcheons: Same material and finish as related fabrication; sized to conceal attachments.

2.3 FABRICATION

- A. Fit and shop assemble components in largest practical sizes for delivery to site.
- B. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.
- C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Interior Components: Continuously seal joined pieces by continuous welds.
- F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- G. Accurately form components to each other and to building structure.
- H. Accommodate for expansion and contraction of members and building movement

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive work.
- C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall-mounted handrails.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete with setting templates, to appropriate sections.

3.3 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Anchor railings to structure with weld plates.
- C. Field weld anchors as indicated on Drawings. Touch-up welds with primer. Grind welds smooth.
- D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- C. Maximum Offset From Alignment: 1/4 inch.
- D. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 7000

DECORATIVE METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel and glass guardrail at Level 2.
 - 2. Stair Three (3) construction.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 - Cast-In-Place Concrete: Execution requirements for anchors specified in this section.
 - 3. Section 05 1200 – Structural Steel: AESS requirements.
 - 4. Section 05 5000 - Metal Fabrications: Concealed attachment bent plates and angles for ornamental metal, including anchorage.
 - 5. Section 06 2000 - Finish Carpentry: Wood handrail.
 - 6. Section 07 9000 - Joint Protection.
 - 7. Section 08 8000 - Glazing: Glass infill panels
 - 8. Section 09 90 00 - Painting and Coating: Field applied paint finish.

1.2 REFERENCES

- A. American Society of Civil Engineers:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

- B. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 4. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 5. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 6. ASTM A297/A297M - Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application.
 - 7. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 8. ASTM A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
 - 9. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - 10. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
 - 11. ASTM A368 - Standard Specification for Stainless Steel Wire Strand.
 - 12. ASTM A473 - Standard Specification for Stainless Steel Forgings.

13. ASTM A479/A479M - Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
 14. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 15. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 16. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
 17. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
 18. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 19. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
 20. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 21. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 22. ASTM F436 - Standard Specification for Hardened Steel Washers.
 23. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
 24. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
 25. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
 2. AWS D1.1 - Structural Welding Code - Steel.
 3. AWS D1.2 - Structural Welding Code - Aluminum.
 4. AWS D1.3 - Structural Welding Code - Sheet Steel.
 5. AWS D1.6 - Structural Welding Code - Stainless Steel.
- D. Federal Specification Unit:
1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- E. National Ornamental & Miscellaneous Metals Association:
1. NOMMA Guideline 1 - Joint Finishes.
- F. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Paint.
 2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
 3. SSPC SP 2 - Hand Tool Cleaning.

1.3 STRUCTURAL REQUIREMENTS

- A. Design railing assembly and attachments to withstand 50 pounds per foot or a nonconcurrent concentrated force of 200 lbs applied in any direction at any point on the handrail and top rail. Design guardrail panels and/or pickets for a uniform load of 25 pounds per square foot, nonconcurrent with rail loads.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Show sections and plans of stairs, dimensions and assembly of components, including railings, handrail, brackets, reinforcements, anchors, welded and bolted connections.
 - 1. Indicate metal profiles, patterns, sizes, connection attachments, anchorage, size and type of fasteners, accessories, and interface with adjacent work.
 - 2. Show all field connections.
 - 3. Provide setting diagrams for installation of anchors, location of pockets, weld plates for attachment of rails to structure, and blocking for attachment of wall rail.
 - 4. Specify adequate back up support for anchoring handrail bracket.
 - 5. Indicate all required field measurements
- C. Product Data: Submit data for manufactured finish materials, and accessories.
- D. Samples:
 - 1. Submit three samples of railing glass, hardware and wood cap.

1.5 INFORMATIONAL SUBMITTAL

- A. Design Data: Submit calculations with material properties, and other information for systems that have loading requirements. Structural calculations shall be certified by a specialty structural engineer licensed in the State of Minnesota.

1.6 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional : For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.

- 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Paints and Coatings : Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.7 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Submit for maintaining metal finishes. Include care and cleaning instructions, list of recommended cleaning and polishing materials.

1.8 QUALITY ASSURANCE

- A. Fabricate ornamental steel components in accordance with Architecturally Exposed Structural Steel (AESS) standards.
- B. Perform welding in accordance with:
 - 1. Steel: AWS D1.1.
 - 2. Sheet Steel: AWS D1.3.
 - 3. Aluminum: AWS D1.2.
 - 4. Stainless Steel: AWS D1.6.
- C. C. Regulatory Requirements
 - 1. Components and installation are to be in accordance with state and local code authorities
 - 2. Components and installation are to follow current ADA and ICC/ANSI A117.1 guidelines.

1.9 QUALIFICATIONS

- A. Fabricator: Company specializing in manufacturing Products specified in this section with minimum ten years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum ten years documented experience and approved by manufacturer.
- C. Welders: AWS certified within previous 12 months.

1.10 MOCKUP

- A. Section 01 4000 - Quality Requirements: Requirements for mockup.
- B. Construct mockup of steel and glass guardrail, one railing module long, including all steel, glass and fastener components that will be present in final installation.

- C. Remove mockup when directed by Architect/Engineer.

1.11 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Protect shop finished metal surfaces with wrapping or strippable coating before shipping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
- C. Accept ornamental metal on site in manufacturer's protective packaging. Inspect for damage.
- D. Store decorative metal indoors, in temperature and humidity controlled environment. Store ornamental metal to prevent distortion of fabricated shape. Puncture protective wrappings at ends for ventilation.
- E. Protect metal finishes from surface contamination, staining, scratching, abrasion, and other physical damage when handling and during installation.

1.13 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Steel Materials:
 - 1. Steel Sections: ASTM A36/A36M.
 - 2. Steel Plate: ASTM A36/A36M.
 - 3. Pipe: ASTM A53/A53M, seamless Grade A.
 - 4. Welding Materials: AWS D1.1; type required for materials being welded.
- B. Stainless Steel:
 - 1. Pipe and Tubing: ASTM A 312.
 - 2. Bolts at Guardrail: Stainless Steel.
- C. Glazing: Refer to Section 08 8800 – Glazing, for glass type.
- D. Glass Standoffs: Stainless steel standoffs with caps and neoprene gaskets.

- E. Wood Cap at Guardrail: Refer to Section 06 6200 Finish Carpentry, for material specification.
- F. Wood Flooring: Refer to Section 09 6400 – Wood Flooring, for tongue and groove planks.

2.2 ACCESSORIES

- A. Sealant: As specified in Section 07 9000.
- B. Backing Paint: Protective Backing Paint: Zinc molybdate alkyd.
- C. Sleeves: ASTM A53/A53M, Schedule 40, galvanized steel pipe with steel plate closure welded to bottom of sleeve. Furnish with sleeve inside diameter 1/4 inch greater than outside diameter of inserted fabrication.

2.3 FABRICATION

- A. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Coordinate required locations of drilled holes in guardrail glass panels with glazing supplier. Glazing panels to be shop drilled. Field cutting not permitted.
- D. Fabricate components with joints tightly fitted and secured. Use concealed fastenings wherever possible. Provide fittings to accommodate site assembly and installation.
- E. For welded joints, grind exposed joints flush and smooth with adjacent finish surface.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component. Exposed fastenings are permitted only where shown on Drawings.
- G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 SHOP FINISHING

- A. Steel Finishes:
 - 1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
 - 2. Do not paint surfaces in direct contact with concrete or where field welding is required.

3. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
 4. Prepare for field finishing in accordance with AESS standards.
- B. Apply one coat of bituminous paint to concealed metal surfaces in contact with cementitious or dissimilar metals.

2.5 FABRICATION TOLERANCES

- A. Maximum Variation from Square: 1/8 inches difference in length of diagonal dimensions.
- B. Maximum Variation from Indicated Size: 1/16 inches.
- C. Maximum Variation from Plane: 1/8 inches bow, measured from straight edge across face of fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify field conditions are acceptable and are ready to receive Work.
- C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall-mounted handrails.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.
- C. Apply protective backing paint to metals in contact with cementitious materials or dissimilar metals.

3.3 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.
- C. Anchor fabrications to structure as indicated on Drawings.
- D. Field weld components indicated on Drawings. Grind welds smooth.

- E. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- F. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.
- G. Assemble fabrications with tight, hairline joints. Exercise care when installing components so as not to damage finish surfaces. Touch up as required to repair damaged finishes.
- H. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Indicated Position: 1/8 inch.
- C. Maximum Variation From Plumb: 1/8 inches in ten feet.
- D. Maximum Offset From Indicated Alignment: 1/8 inches.
- E. Maximum Offset Between Adjacent Components: 1/8 inches.

3.5 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Adjust moveable components for smooth operation.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Remove protective material from shop finished surfaces.
- C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect finished Work from damage.

END OF SECTION

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes;
 - 1. Non-structural dimension lumber.
 - 2. Roof related wood blocking, nailers, sheathing and cants for roofing and items installed on roof.
 - 3. Preservative treated wood materials.
 - 4. Fire retardant treated wood materials.
 - 5. Blocking in wall openings.
 - 6. Concealed wood blocking for support of handrails and grab bars.
 - 7. Communications and electrical room mounting boards

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 – Cast-in-Place Concrete: Concrete openings to receive wood blocking.
 - 3. Section 04 4200 – Unit Masonry: Masonry openings to receive wood blocking.
 - 4. Section 05 3123: Metal roof decking to receive wood curbs.
 - 5. Section 09 2116 - Gypsum Board Assemblies: Metal backing plate.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A208.1 - Mat-Formed Wood Particleboard.

- B. American Wood-Preservers' Association:
 - 1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
 - 2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

- C. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- D. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

- E. National Institute of Standards and Technology:
 - 1. NIST PS 20 - American Softwood Lumber Standard.

- F. Southern Pine Inspection Bureau:
 - 1. SPIB - Standard Grading Rules for Southern Pine Lumber.

- G. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- H. West Coast Lumber Inspection Bureau:
 - 1. WCLIB - Standard Grading Rules for West Coast Lumber.
- I. Western Wood Products Association:
 - 1. WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content. For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
 - 1. Include statement indicating costs for each product containing certified wood.
 - 2. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
- C. Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
- D. Product Data for each composite wood and agrifiber product used indicating that products contain no urea-formaldehyde resin.
 - 1. Include statement indicating adhesives and binders used for each product indicating that the adhesive contains no urea formaldehyde.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:

1. Lumber Grading Agency: Certified by NIST PS 20.
 2. Plywood Grading Agency: Certified by APA/EWA.
- B. Surface Burning Characteristics:
1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- C. Apply label from agency approved by authority having jurisdiction to identify each fire retardant treated material.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Dimension Lumber: PS 20, graded in accordance with NFPA Grading Rules; kiln-dried to a maximum moisture content of 19 percent; standard grade or better; surfacing - four sides (S4S).
1. Sizes: Nominal sizes as indicated on drawings.
 2. Species:
 - a. Framing lumber: any commercial softwood species.
 - b. Furring lumber: No. 2 Common Ponderosa Pine, Sugar Pine, White Fir or Lodgepole Pine.
 3. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - a. Lumber: S4S, No. 2 or Standard Grade.
 - b. Boards: Standard or No. 3.
 - a. All concealed in-wall blocking is metal per Section 09 2166.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
- C. Softwood Plywood: PS 1; C-C Ext grade, exterior quality, kiln-dried to a maximum moisture content of 19 percent, thickness as indicated.

2.2 ROOF RELATED WOOD BLOCKING, SHEATHING & CANTS

- A. Lumber: Non-preserved treated, standard light framing grade, sound and thoroughly seasoned with less than 19 percent moisture content at the time of installation and at time roofing is installed.
1. Douglas Fir
 2. Eastern Pine
 3. No. 2 Western Hemlock
 4. No. 3 Southern Pine
 5. Spruce-Pine-Fir
- B. Plywood: C-D Exposure 1 or better, APA Rated Sheathing, non-preserved treated, meeting U.S. Products Standard PS1 or Performance Standard PRP-108 for Soft Wood Plywood Construction and Industrial. Sound and thoroughly seasoned with less than 19 percent moisture content at the time of installation and at time roofing is installed.
1. Thickness: 3/4-inch unless indicated otherwise.

- C. Wood blocking, sheathing or cants directly in contact with asphalt shall be non-treated. Pressure treated lumber is acceptable where touching new concrete or masonry surfaces or as required by building code. Separate non-treated wood blocking and sheathing which comes in contact with concrete and masonry surfaces by utilizing self-adhering membrane to comply with building code.
- D. Fasteners for blocking and plywood:
 - 1. All bolts shall have standard threads and be complete with washers and nuts. Exterior exposed nails and screws shall be hot-dipped galvanized.
 - 2. Anchoring devices shall be of the proper type and size for intended use and shall be of adequate design to achieve substantial and positive anchorage unless otherwise indicated.
 - a. Lumber-to-lumber: Cement coated or annular thread nails with a minimum 1-1/4-inch penetration into adjoining member.
 - b. Plywood-to-lumber: Nails, ring shank or annular thread nails with a minimum 1-1/4-inch penetration into adjoining member. Screws, minimum #14 flat head countersunk wood screws, zinc or cadmium plated steel or stainless steel, with minimum 1-1/4-inch penetration into adjoining member.
 - c. Lumber/plywood-to-steel deck: Screws, minimum #14 flat head countersunk sheet metal screws, zinc or cadmium plated steel or stainless steel; through 5/8-inch diameter steel washer for lumber.
 - d. Lumber/plywood-to-concrete deck: Tapcon or Gripcon anchors, minimum 1/4-inch diameter with 1-inch minimum penetration and 300 lb minimum withdraw resistance. Other corrosion resistant drilled-in type masonry/concrete anchor may be used if equivalent in pull-out strength. Depending on substrate, penetration length may vary. Check underside of deck to ensure spalling will not occur at any location.

2.3 ACCESSORIES

- A. Fasteners and Anchors at non-roof locations:
 - 1. Fasteners: Hot dipped galvanized steel conforming to ASTM A153, or stainless steel, for high humidity and all treated wood locations. Unfinished steel is acceptable elsewhere.
 - 2. Nails and Staples: ASTM F1667.
 - 3. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolts or power activated type for anchorage to steel.

2.4 PRESERVATIVE WOOD TREATMENT

- A. Comply with applicable requirements of AWPB Standards C2 and C9. Mark each treated item with the AWPB Quality Control Mark indicating compliance with the appropriate AWPB Quality Control Standard.
- B. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.
- C. Moisture Content After Treatment: Kiln-dry lumber and structural panels to maximum moisture content, respectively, of 19 percent and 15 percent.

- D. Pressure treat all lumber and plywood embedded in, bearing on or in contact with masonry or concrete.
- E. Provide wood preservative treatment that does not contain chromium or arsenic.

2.5 FIRE RETARDANT WOOD TREATMENT

- A. Fire Retardant Treatment: Pressure treatment, AWPA C20 for lumber and AWPA C27 for plywood, Interior Type, chemically treated and pressure impregnated. Identify treated wood with appropriate classification marking of Underwriters Laboratories, Inc.
- B. For interior use, provide one of the following fire-retardant-treated products:
 - 1. Hickson Corporation, "Dricon."
 - 2. Hoover Treated Wood Products, "Pyro-Guard."
 - 3. Osmose Wood Preserving Co., "Firepro."
 - 4. Viance LLC, "D-Blaze".
- C. For exterior use, provide Hoover Treated Wood Products, "Exterior Fire-X" products.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

- A. Coordinate placement of blocking, curbing and framing items.

3.3 INSTALLATION

- A. Set members level and plumb, in correct position.
- B. Place horizontal members, crown side up.
- C. Construct curb members of solid wood sections.
- D. Coordinate curb installation with installation of decking and support of deck openings, and parapet construction.
- E. Space framing and furring 16 inches oc.
- F. Secure sheathing to framing members with ends over firm bearing and staggered.

- G. Install telephone and electrical panel backboards where indicated on Drawings. Size back boards a minimum of 6 inches beyond size of electrical and telephone panel. Extend full length of wall in electrical rooms.

END OF SECTION

SECTION 06 2000

FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Finish carpentry items.
 - 2. Atrium stair wood components.
 - 3. Free standing benches.
 - 4. Hardware and attachment accessories.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 7000 – Decorative Metal Fabrications: Wood guardrail cap.
 - 3. Section 06 1053 - Miscellaneous Rough Carpentry: Grounds and support framing; concealed wood blocking.
 - 4. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
 - 5. Section 08 1400 - Flush Wood Doors.
 - 6. Section 08 8300 – Mirrors: Backer board for mirrors.
 - 7. Section 09 6413 – Wood Flooring: Stair 3 wood plank surfacing.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A156.9 - Cabinet Hardware.
 - 3. ANSI A208.1 - Mat-Formed Wood Particleboard.

- B. APA-The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

- C. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- D. Architectural Woodwork Institute:
 - 1. AWI - Quality Standards Illustrated.

- E. American Wood-Preservers' Association:
 - 1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.

- F. Federal Specification Unit:
 - 1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

- G. Hardwood Plywood and Veneer Association:

1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
- H. National Institute of Standards and Technology:
1. NIST PS 20 - American Softwood Lumber Standard.
- I. National Electrical Manufacturers Association:
1. NEMA LD 3 - High Pressure Decorative Laminates.
- J. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- K. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- L. Window and Door Manufacturers Association:
1. WDMA I.S.4 - Water-Repellent Treatment for Millwork.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes.
- C. Product Data:
1. Submit data on fire retardant treatment materials and application instructions.
- D. Samples:
1. Submit three samples of finish plywood, 10 x 10 inch in size illustrating wood grain and specified finish.
 2. Submit three samples of laminates, hardware items, and shop finishes.
 3. Submit two mock-up samples of the following:
 - a. Stair 3 nosing (full size – 6” long).
 - b. Hardwood guardrail cap.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content. For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.

4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
 1. Include statement indicating costs for each product containing certified wood.
 2. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
- C. Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
- D. Product Data for each composite wood and agrifiber product used indicating that products contain no urea-formaldehyde resin.
 1. Include statement indicating adhesives and binders used for each product indicating that the adhesive contains no urea formaldehyde.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Custom Grade.
- B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 QUALIFICATIONS

- A. Fabricator: Company specializing in fabricating the products specified in this section with minimum ten years documented experience. Fabricators must be certified members of the Architectural Woodwork Institute (AWI).

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Deliver woodwork under cover. Protect from sub-zero temperatures during delivery. Do not deliver until plaster work, drywall joint treatment and similar moisture producing materials have dried out for at least 15 days, or until relative humidity is less than 60%, and in cold weather, until heat has been provided for at least 10 days prior to delivery.
- C. Protect work from damage, especially due to excessive or inadequate relative humidity.
- D. Store indoors, in ventilated areas with constant minimum temperature of 60 degrees F (15 degrees C) and maintain relative humidity at the site between 25% and 55% before, during and after installation.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 SEQUENCING

- A. Section 01 1000 - Summary: Work sequence.
- B. Sequence work to ensure utility connections are achieved in orderly and expeditious manner.

1.10 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.1 COMPONENTS

2.2 SOLID WOOD MATERIALS

- A. Softwood Lumber: PS 20; Graded in accordance with AWI Quality Grade I, maximum moisture content of 6-8 percent; and the following:
 - 1. Species of Wood: Pine or fir.
 - 2. Cut or Slicing of Wood: flat or plain.
 - 3. Finish Quality: Suitable for opaque finish.
 - 4. Wood Treatment: Fire retardant.
- B. Hardwood Lumber: Graded in accordance with AWI Quality Grade I; maximum moisture content of 6-8 percent; and the following:
 - 1. Species of Wood: White Oak.
 - 2. Cut or Slicing of Wood: quarter sawn.
 - 3. Finish Quality: Suitable for transparent finish.

2.3 SHEET MATERIALS

- A. Softwood Plywood: APA/EWA PS 1 Grade C-D softwood plywood and the following:
 - 1. Core: particleboard, fire retardant.
 - 2. Face Species of Veneer: White Pine..
 - 3. Cut or Slicing of Veneer: rotary.
- B. Hardwood Plywood: AWI Grade AA face veneers with type of glue recommended for application; and the following:
 - 1. Species of Wood: White Oak.
 - 2. Cut or Slicing of Wood: quarter sawn.
 - 3. Finish Quality: Suitable for transparent finish.

- C. Hardboard: AHA A135.4; pressed wood fiber with resin binder, tempered grade, 1/4 inch thick, smooth one side.
- D. Synthetic Surfacing: Refer to Specification Sections 06 6115, 06 6116 and 06 6119.

2.4 LAMINATE MATERIALS

- A. Basis of Design Manufacturers: See Division 9 Finish Materials for interior materials.

2.5 ACCESSORIES

- A. Adhesive for High Pressure Decorative Laminates: Type recommended by laminate manufacturer to suit application.
- B. Fasteners: Of size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome plated finish in concealed locations and stainless steel, or chrome-plated finish in exposed locations.
 - 1. Coordinate the material and finish of any exposed fasteners with Section 08 7100 - Door Hardware and architect prior to selection.
- D. Concealed Joint Fasteners: Threaded steel.
- E. Veneer Edge Band: Standard wood veneer edge band matching face veneer.
- F. Wood Filler: As recommended by AWI, tinted to match surface finish color.

2.6 FABRICATION

- A. Fabricate to AWI Custom Quality Standards.
- B. Shop assemble work for delivery to site, permitting passage through building openings.
- C. Fit exposed sheet material edges with matching hardwood edging. Use one piece for full length only.
- D. Shop prepare and identify components for grain matching during site erection.
- E. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

2.7 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.

- D. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:
 - 1. Transparent:
 - a. AWI System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
 - b. Stain: As selected by Architect.
 - c. Sheen: Satin.
- E. Seal internal and semi-concealed surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify adequacy of backing and support framing.
- C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 EXISTING WORK

- A. Modify and extend existing finish carpentry installations using materials and methods as specified.

3.3 INSTALLATION

- A. Install work in accordance with AWI [Custom] [Premium] Quality Standards.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (1 mm). The use of additional overlay trim to conceal larger gaps will not be allowed.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation from Indicated Position: 1/16 inch.
- C. Maximum Offset from Alignment with Abutting Materials: 1/32 inch.

3.5 SCHEDULE OF FINISH CARPENTRY ITEMS

- A. The list indicated below is intended to serve as a guide and should not be construed as complete. Refer to Drawings for details.
 - 1. Stair No. 3:
 - a. Refer to Section 09 6413 for wood tongue and groove flooring material.
 - b. Solid hardwood stair risers.
 - c. Solid hardwood cap at guardrail.

2. Solid hardwood cap at guardrail on Second Floor.
3. Free standing Benches
 - a. Refer to Section 09 6413 for wood tongue and groove flooring material.
 - b. Solid hardwood trim.

END OF SECTION

SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Specially fabricated custom cabinet units.
 - 2. Cabinet hardware.
 - 3. Factory finishing.
 - 4. Preparation for installing utilities.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 06 1053 - Miscellaneous Rough Carpentry: Grounds and support framing.
 - 3. Section 06 2000 - Finish Carpentry: Related trim not specified in this section.
 - 4. Section 06 6115 – Paper Composite Fabrications: Counter tops, casework and wall base.
 - 5. Section 06 6119 – Quartz Surfacing Fabrications: Counter tops.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A156.9 - Cabinet Hardware.
 - 2. ANSI A208.1 - Mat-Formed Wood Particleboard.

- B. Architectural Woodwork Institute:
 - 1. AWI - Quality Standards Illustrated.

- C. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- D. Federal Specification Unit:
 - 1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

- E. National Electrical Manufacturers Association:
 - 1. NEMA LD 3 - High Pressure Decorative Laminates.

- F. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 - 2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

- G. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
- C. Product Data: Required for all specialty items not manufactured by woodwork fabricator, including hardware.
- D. Samples:
 - 1. Submit three samples of finish plywood, 10 x 10 inch in size illustrating wood grain and specified cabinet finish.
 - 2. Submit three samples of wood trim 10 inches long, illustrating wood grain and specified cabinet finish.
 - 3. Submit three samples of hardware items, and other specialty items.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content. For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
 - 1. Include statement indicating costs for each product containing certified wood.
 - 2. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
- C. Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
- D. Product Data for each composite wood and agrifiber product used indicating that products contain no urea-formaldehyde resin.
 - 1. Include statement indicating adhesives and binders used for each product indicating that the adhesive contains no urea formaldehyde.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Custom Grade.
- B. Surface Burning Characteristics: Where indicated on Drawings, provide maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 QUALIFICATIONS

- A. Fabricator: Company specializing in fabricating the products specified in this section with minimum ten years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Protect units from moisture damage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Deliver woodwork under cover. Protect from sub-zero temperatures during delivery. Do not deliver until plaster work, drywall joint treatment and similar moisture producing materials have dried out for at least 15 days, or until relative humidity is less than 60%, and in cold weather, until heat has been provided for at least 10 days prior to delivery.
- C. Protect work from damage, especially due to excessive or inadequate relative humidity.
- D. Store indoors, in ventilated areas with constant minimum temperature of 60 degrees F (15 degrees C) and maintain relative humidity at the site between 25% and 55% before, during and after installation.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 CUSTOM CABINETS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Grades as indicated. See Division 9 Section Finish Materials for interior materials.

- B. Wood Veneer Faced Cabinets: Custom grade.
 - 1. Exposed Surfaces: Grade AA, species as listed in Section 09 0502, quarter sawn, slip-matched.
 - 2. Concealed Surfaces: Grade B, species as listed in Section 09 0502, rotary cut, random-matched.

2.2 SOLID WOOD MATERIALS

- A. Hardwood Lumber: Graded in accordance with AWI Quality Grade I; maximum moisture content of 6-8 percent; and the following:
 - 1. Species of Wood: White Oak.
 - 2. Cut or Slicing of Wood: quarter sawn.
 - 3. Finish Quality: Suitable for transparent finish.

2.3 SHEET MATERIALS

- A. Hardwood Plywood: AWI Grade AA face veneers with type of glue recommended for application; and the following:
 - 1. Species of Wood: White Oak.
 - 2. Cut or Slicing of Wood: quarter sawn.
 - 3. Finish Quality: Suitable for transparent finish.
- B. Hardboard: AHA A135.4; pressed wood fiber with resin binder, tempered grade, 1/4 inch (6 mm) thick, smooth one side.
- C. Synthetic Surfacing: Refer to Specification Sections 06 6115, 06 6116 and 06 6119.

2.4 LAMINATE MATERIALS

- A. Basis of Design: See Section 09 0502 - Finish Materials for laminate selections.

2.5 ACCESSORIES

- A. Adhesive: Type recommended by AWI/AWMAC to suit application.
- B. Fasteners: Size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome plated finish in concealed locations and stainless steel, or chrome-plated finish in exposed locations.
 - 1. Coordinate the material and finish of any exposed fasteners with Section 08 7100 - Door Hardware and architect prior to selection.
- D. Concealed Joint Fasteners: Threaded steel.

2.6 HARDWARE

- A. Hardware: BHMA A156.9, types as indicated for quality grade specified.
- B. Unless noted otherwise, all hardware shall be #626 / #630 finish

- C. Countertop support: side mounted clear anodized aluminum. Manufacturer: Häfele product No.505.14.916
- D. Shelf Supports: Knappe & Vogt 331 Series flat top shelf support pin, anochrome finish for 1/4 inch diameter hole.
 - 1. Provide 2 per side for any shelf 14 inches deep or less.
 - 2. Provide 3 per side for any shelf above 14 inches in depth. This three hole requirement is NOT shown on the drawings.
- E. Drawer and Door Pulls:
 - 1. Forms and Surfaces: 'Mesa', HC433; 3.5 inch wide with 3 inch centers, in clear satin finished aluminum.
- F. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
 - 1. Product: BHMA A156.11, Grade 2 manufactured by Best. Series 5L number 5I7RD2626 or approved.
 - 2. Provide locks for lower cabinet doors only in Rooms 1- 104B, 1-141, 2-110, 3-110 (south wall) and 4-110 (south wall).
- G. Drawer Slides:
 - 1. Acceptable Manufacturers: Accuride International, Inc;
 - 2. Drawers 24 in. wide or less: Accuride 7432, full extension, all ball bearing slide, with rail mount, full extension + 1 in. over travel, hold-in detent, 100 lbs./pr. load rating, and progressive movement.
 - a. Standard finish: clear zinc.
 - 3. Drawers 25 to 30 in. wide: Accuride 3132EC, fully concealed undermount slide with ball bearing and polymer rollers, with lever disconnect, full extension, and 100 lbs./pr. load rating.
 - a. Standard finish: clear zinc.
- H. Hinges for Swing Doors: European style, 3/4 inch, self-closing, flush overlay type, as manufactured by Grass America. Finish: Steel with satin finish.
- I. Horizontal Cabinet Door Awning Hinge: Hafele Flipper Door: Easy-Down, or Accuride 1155
- J. Cable Grommet: Hafele: Matte Nickel; 63mm dia. #631.46.602

2.7 FABRICATION

- A. Fabricate to AWI Custom Quality Standards.
- B. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- C. Fit exposed sheet material edges with 3/8 inch matching hardwood edging for wood veneer casework.. Use one piece for full length only.
- D. Cap exposed high pressure decorative laminate finish edges with plastic trim.

- E. Door and Drawer Fronts: 3/4 inch thick; flush overlay style.
- F. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.
- G. Apply high pressure decorative laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.
- H. Apply wood veneer by grain matching adjacent sheets to slip matching.
- I. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- J. Fabricate cabinets and counter tops with cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

2.8 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.
- D. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:
 - 1. Transparent:
 - a. AWI System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
 - b. Stain: As selected by Architect.
 - c. Sheen: Satin.
- E. Seal surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify adequacy of backing and support framing.
- C. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

- A. Install work in accordance with AWI Custom Quality Standards.
- B. Set and secure casework in place; rigid, plumb, and level.

- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting and balancing.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.5 SCHEDULE OF WOOD CASEWORK ITEMS

- A. The list indicated below is intended to serve as a guide and should not be construed as complete. Refer to Drawings for details.
 - 1. Cabinetry at kitchenettes.
 - 2. Cabinetry at copy areas.
 - 3. Lab Caddies at entrances to labs.
 - 4. Cabinetry at Conference Rooms.

END OF SECTION

SECTION 06 6115

PAPER COMPOSITE FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes;
 - 1. Countertops for architectural casework.
 - 2. Wall base.
 - 3. Casework – Refer to Section 06 4100.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 06 1053 - Miscellaneous Rough Carpentry: Wood blocking and supports.
 - 3. Section 06 4100 - Architectural Wood Casework.
 - 4. Section 09 0502 – Finish Material Legend.

1.2 REFERENCES

- A. ASTM International:
 - 1. ANSI A208.1 - American National Standard for Particleboard; 1999.
 - 2. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2002.
 - 3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- B. Underwriters Laboratories Inc.:
 - 1. UL - Fire Resistance Directory.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

- C. AWI/AWMAC (QSI) - Quality Standard Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2003.

- D. PS 1 - Construction and Industrial Plywood; 1995.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, methods of support, and anchorages.

- C. Product Data: Submit data on specified products.

- D. Submit two samples of each type of solid surface material. Sample size is to be minimum 2" x 2". Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.

1.4 MANUFACTURER'S INSTALLATION INSTRUCTIONS:

- A. Submit preparation of opening required, rough-in sizes; [furnish templates for cast-in or placed frames or anchors;] tolerances for item placement, and temporary bracing of components.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content. For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Submit documentation of locally-sourced products (manufacture within 500 miles of project site); certify location of harvest and manufacture.
- C. Submit documentation for Certificates of chain-of-custody signed by manufacturers certifying products specified to be made from certified wood were made from certified wood obtained from forests certified by an FSC-accredited certification body to comply with FSC1.2 *Principles and Criteria*.
- D. Submit documentation for paper products made without formaldehyde; certify that product is formaldehyde-free.
- E. Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required; list of substances harmful to component materials. Include instructions for stain removal, surface and gloss restoration.

1.7 QUALITY ASSURANCE

- A. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 QUALIFICATIONS

- A. Fabricator Qualifications: Authorized fabricator by material manufacturer.

1.9 MAINTENANCE

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Material: Paper Composite Solid Surface (SSM-1).
 - 1. Basis of Design: Richlite Company.
 - a. Refer to Section 09 0502 for color selection.
 - b. Size: Refer to drawings.
 - c. Thickness: 1/2 inch minimum.
 - d. Finish: Matte with field applied sealer.
 - 2. Substitutions: Under provisions of Section 01 6000.
- B. Adhesives: Chemical resistant two-part epoxy waterproof adhesive as recommended by manufacturer.
- C. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in color-matching or clear formulations.

2.2 FABRICATION

- A. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.
- B. Fabricate in accordance with standards governing fabrication quality in accordance with AWI's Quality Standard Illustrated.
- C. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
 - 4. Place seams to run full width of countertop, and at natural positions such as corners and midpoints as indicated on drawings.
 - 5. Cut and place sections with the grain of the material running crosswise to the width of the surface.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install work in accordance with AWI Custom Quality Standards.
- B. Install components plumb and level, in accordance with approved shop drawings and product installation details.
- C. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant.
- D. Remove adhesives, sealants and other stains.
- E. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to architect's satisfaction.
- F. Fabricator/Installer is to provide care and maintenance information review maintenance procedures and the manufacturer's warranty with the head of maintenance upon completion of project.

3.4 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.

END OF SECTION

SECTION 06 6119

QUARTZ SURFACING FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes quartz surfacing for countertops and backsplashes.
- B. Related Sections
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 06 4100 - Architectural Wood Casework: Cabinets with quartz surfacing counter top and backsplash.
 - 3. Section 06 6115 – Paper Composite Fabrications: Countertops, casework and base.
 - 4. Section 07 9000 - Joint Protection: Perimeter sealant to adjacent construction.

1.2 REFERENCES

- A. ASTM International:
 - 1. C97 Absorption and Bulk Specific Gravity of Dimension Stone.
 - 2. C99 Modulus of Rupture of Dimension Stone.
 - 3. C170 Compressive Strength of Dimension Stone.
 - 4. C484 Thermal Shock Resistance of Grazed Ceramic Tile.
 - 5. C531 Linear Shrinkage and Coefficient of Thermal Expansion of Chemical - Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concrete.
 - 6. C648 Breaking Strength of Ceramic Tile.
 - 7. C1026 Resistance of Ceramic Tile to Freeze Thaw Cycling.
 - 8. C1028 Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method.
 - 9. E84 Surface Burning Characteristics of Building Materials.
 - 10. E662 Specific Optical Density of Smoke Generated by Solid Materials.
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z124.6 Stain Resistance

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings:
 - 1. Drawings to include countertop layout, dimensions, required locations of support and blocking members, edge profiles, cutouts and attachments.
- C. Product Data:
 - 1. Quartz Surfacing; Submit manufacturer's product data.
- D. Samples:

1. Submit two samples of each type of solid surface material. Sample size is to be 4" x 4" Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.
 2. Adhesive: Submit two samples of adhesive joint for each color quartz surface selected.
- E. Fabricator Qualifications:
1. Work of this section shall be performed by a certified fabricator/installer certified in writing by the manufacturer.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required; list of substances harmful to component materials, Include instructions for stain removal, surface and gloss restoration.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Packaging, Shipping, Handling and Unloading:
 - 1. Observe manufacturer's recommendations and handle in a manner to prevent breakage. Brace parts if necessary.
 - 2. Transport in the near vertical position with finished face toward finished face. Do not allow finished surfaces to rub during shipping and handling.
- B. Storage and Protection:
 - 1. Store in racks in near vertical position. Prevent warpage and breakage.
 - 2. Store inside away from direct exposure to sunlight. Store between 25 and 130° F.

1.7 WARRANTY

- A. Closeout Submittals:
 - 1. Provide manufacturer's completed warranty form.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
 - 1. Cambria (basis of design).
 - 2. Substitutions: Under provisions of Section 01 1600.

2.2 QUARTZ MATERIALS

- A. Material:
 - 1. Homogeneous mixture containing 93% pure quartz with additions of high performance polyester resin, pigments and special effects.
- B. Quartz Surface Type (SSM-2 and SSM-3)
 - 1. Refer to Section 09 0502 for color selections.
 - 2. Thickness: 2 cm.
 - 3. Finish: Polished.
- C. Exposed Edges and Corners:
 - 1. Countertops: Eased edge profile.
 - 2. Backsplash: Eased edge profile.
- D. Performance:
 - 1. Moisture Absorption: typical results 0.02%; ASTM C97
 - 2. Modulus of Rupture: typical results 6,800 psi; ASTM C99
 - 3. Compressive Strength: typical results 24,750 psi; ASTM C170
 - 4. Abrasion Resistance: typical results 223; ASTM C501
 - 5. Bond Strength: typical results 205 psi; ASTM C482
 - 6. Thermal Shock: passes 5 cycles: ASTM 484

7. Coefficient of Thermal Expansion: typical results 1.2×10^{-5} inch/°F; ASTM C531
8. Breaking Strength of Tile: typical results 3,661 lbf; ASTM C648
9. Resistance to Freeze Thaw Cycling: unaffected 15 cycles; ASTM C1026
10. Coefficient of Friction Pull Method: .75 avg. dry / .55 avg. wet; ASTM C1028
11. Surface Burning Characteristics: typical results 17; ASTM E84
12. Smoke Density: flaming 196, non-flaming 69; ASTM E662
13. Stain Resistance: Unaffected; ANSI Z124.6

2.3 ACCESSORIES

- A. Mounting Adhesive:
 1. Provide structural grade '50 year' silicone or epoxy adhesive.
- B. Acceptable epoxy manufactures:
 1. Akemi North America.
 2. Cambria Two Part Acrylic Adhesive.
 3. Bonstone Material Corporation.
 4. Tenax USA.
- C. Quartz Surface Adhesive:
 1. Provide epoxy or polyester adhesive of a type recommended by manufacturer for application and conditions of use.
 2. Acceptable manufacturers:
 - a. Akemi North America.
 - b. Cambria Two Part Acrylic Adhesive.
 - c. Bonstone Material Corporation.
 - d. Tenax USA.
 3. Adhesive that will be visible in finished work shall be tinted to match quartz surface.
- D. Joint Sealant:
 1. Clear sealant of type recommended by manufacturer for application and use.
 2. Provide anti-bacterial type in toilet, bath, and food preparation areas.
 3. Acceptable manufacturers:
 - a. Dow Corning.
 - b. GE Sealants.
- E. Solvent: Denatured alcohol for cleaning quartz surfacing to assure adhesion of adhesives and sealants.
- F. Cleaning Agents: Mild soap and water.

2.4 FABRICATION

- A. Fabrication shall be by a certified Fabricator, approved in writing by Manufacturer.
- B. Layout surface to minimize joints and avoid L-shaped pieces of quartz surfacing. Layout and fabricate with 'hairline' joints.

- C. Inspect materials for defects prior to fabrication.
- D. Tools: Cut and polish with water-cooled powered tools.
- E. Cutouts:
 - 1. Cutouts shall have a minimum of 3/8 inch radius.
 - 2. Where edges of cutouts will be exposed in finished work; polish edges.
- F. Laminations:
 - 1. Laminate layers of quartz surfacing as required to create built up edges following procedures recommended by the manufacturer.

PART 3 EXECUTION

3.1 PRE-INSTALLATION EXAMINATION

- A. Site Verification:
 - 1. Verify dimensions by field measurements prior to installation.
 - 2. Verify that substrates supporting quartz surfaces are plumb, level and flat to within 1/8 inch in 10 feet and that all necessary supports and blocking are in place.
 - 3. Base Cabinets shall be secured to adjoining units and back wall.
- B. Inspection of Quartz Surfaces: Inspect materials for defects prior to installation.

3.2 PREPARATION

- A. Clean surfaces prior to installation.
- B. Protection of Quartz Surfaces:
 - 1. Protect finished surfaces from scratches. Apply masking where necessary.
 - 2. Take necessary precautions to prevent dirt grit dust and debris from other trades from contacting the surface.

3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions and approved shop drawings.
- B. Preliminary Installation:
 - 1. Position materials to verify the correct size.
 - 2. If size adjustments, or additional fabrication is necessary, use water-cooled tools. Protect jobsite and surface from dust and water. Perform work away from installation site if possible.
 - 3. Allow gaps for expansion of not less than 1/8 inch(1.5mm) per ten feet when installed between walls or other fixed structure.
- C. Permanent Installation:

1. After verification of fit and finish, clean substrate; remove loose and foreign matter that may interfere with adhesion. Clean quartz surface backside & joints with denatured alcohol.
2. Horizontal surface: Apply continuous bead of mounting adhesive around perimeter of structural substrate and supports.
3. Vertical surface: Apply continuous bead of mounting adhesive around perimeter. In addition, apply ¼ inch mounting adhesive bead every 8 inches on vertical center.
4. Install quartz surfacing plumb, level, square and flat to within 1/8 inch in ten feet, non-cumulative.
5. Align adjacent pieces in same plane.

D. Joints:

1. Joints Between Adjacent Pieces of Quartz Surfacing:
 - a. Joints shall be flush, tight fitting, level and neat.
 - b. Securely join adjacent pieces with Cambria Two Part Acrylic Adhesive.
 - c. Fill joints level to polished surface.
 - d. Secure adjacent quartz surfaces with vacuum clamps until adhesive hardens.
2. Joints Between Quartz Surface and back splash. Seal joints with '50' year silicone sealant.

3.4 REPAIR

- A. Repair or replace damaged material in a satisfactory manner.

3.5 CLEANING

- A. Remove masking, excessive adhesive and sealants. Clean exposed surfaces with denatured alcohol.

3.6 PROTECTION

- A. Protect installed fabrications with non-staining sheet coverings.

END OF SECTION

SECTION 06 7400

FIBERGLASS MOLDED GRATING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fiberglass reinforced plastic (FRP) gratings at lab pits.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 – Cast-in-Place Concrete: Concrete walls.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E 84 Surface Burning Characteristics of Building Materials
 - 2. ASTM D 635 Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Product data: Provide data on all cleaning, galvanizing, and finishing products, including VOC content where applicable.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 1. Verify field conditions and dimensions.
 - 2. Receive and comply with reviewed shop drawings prior to fabrication.
- D. Samples: Submit three 6 x 6 inch in size illustrating factory finishes.
- E. Design Calculations: Submit calculations and related details prepared, sealed, and signed by registered design professional licensed to practice structural engineering in the State of Minnesota.
 - 1. Include calculations and details for loadings and stresses for all grating under provisions of Section 01 3300.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience. Manufacturer shall be certified to the ISO 9001-2000 standard.
- B. Installer: Company specializing in performing work of this section minimum ten years documented experience and approved by manufacturer.

1.5 PRODUCT DELIVERY AND STORAGE

- A. Deliver Materials in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer.
- B. All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage.
- C. Adhesives, resins and their catalysts are to be stored in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Fibergrate Micro-Mesh (ADA); 1-1/2" deep with top openings 3/4" square. Color: Grey. Products by manufacturers listed below are acceptable.
- B. American Grating, LLC.
- C. AMD Inc.
- D. Fibergrate Composite Structures, Inc.
- E. Substitutions: Under provisions of Section 01 6000.

2.2 GENERAL

- A. All FRP items shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
- B. Load/Deflection: Grating design loads shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be designed for a uniform live load of 125 psf or concentrated load of 300 lb. Deflection is not to exceed 0.375" or $L/D = 120$, whichever is less.
- C. The manufacturer shall certify that the stiffness of all panels manufactured are never more than 2.5% below the published load-deflection values.
- D. Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.
- E. All finished surfaces of FRP items and fabrications shall be smooth, resin rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

- F. All grating products shall have a tested flame spread rating of 25 or less per ASTM E 84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.
- G. All accessories, including mechanical grating clips, shall be manufactured of Type 316SS (stainless steel).
- H. Provide manufacturers' edge angle for embedment at perimeter of openings to provide solid seating of support grating.

2.3 MOLDED FRP GRATING

- A. Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane.
 - 1. Grating shall have a square mesh pattern providing bidirectional strength.
 - 2. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement shall be no more than 1/8" below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces.
 - 3. Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements.
- B. After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.
- C. Non-slip surfacing: Grating shall be manufactured with a concave, meniscus profile on the top of each bar providing maximum slip resistance.

2.4 GRATING FABRICATION

- A. Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work.
- B. Layout: Each grating section shall be readily removable, except where indicated on drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.
 - 1. Owner will be requesting opening within the grating at each location. Coordination of opening sizes will be handled during the shop drawing process.
- C. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

- D. Hardware: Type 316 stainless steel hold down clips shall be provided and spaced at maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Contractor shall install gratings in accordance with manufacturer's assembly drawings.
- B. Fasten grating panels securely in place with hold down fasteners as specified herein.
- C. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades.
- D. Seal cut or drilled surfaces in accordance with manufacturer's instructions.
- E. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

END OF SECTION

SECTION 07 1300

SHEET WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Sheet membrane waterproofing for use at miscellaneous tie-ins conditions.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 07 1310 - Bentonite Sheet Waterproofing: Foundation wall waterproofing.
 - 3. Section 07 2113 - Board Insulation: Perimeter and horizontal insulation.
 - 4. Section 07 6200 - Sheet Metal Flashing and Trim.
 - 5. Section 07 9000 - Joint Protection.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
 - 2. ASTM D412 – Standard Test Methods for Rubber Properties in Tension.
 - 3. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - 4. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 5. ASTM D822 - Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
 - 6. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - 7. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.
 - 8. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
 - 9. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- B. National Roofing Contractors Association:
 - 1. NRCA - The NRCA Waterproofing and Dampproofing Manual.

1.3 SYSTEM DESCRIPTION

- A. Waterproofing System: Self-adhering membrane capable of preventing moisture migration to interior.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- C. Product Data: Submit data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.
- D. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials : For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing Manual.

1.7 QUALIFICATIONS

- A. Membrane Manufacturer: Company specializing in waterproofing sheet membranes with minimum three years documented experience.
- B. Applicator: Company specializing in performing work of this section with minimum five years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

PART 2 PRODUCTS

2.1 SHEET MEMBRANE WATERPROOFING

- A. Manufacturers:
 - 1. Carlisle Waterproofing Systems.
 - 2. W.R. Grace & Co.
 - 3. W.R. Meadows.
 - 4. Mirafi Moisture Protection.
 - 5. Sarnafil.
 - 6. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Composite Laminate Membrane: Self-adhesive, cold-applied composite sheet comprised of 0.056 inch thick rubberized asphalt and 0.004 inch of cross-laminated, high density polyethylene film formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet which is removed during installation. No special adhesive or heat shall be required to form laps. Membrane shall conform to following criteria:

Properties	Test	Results
Tensile Strength	ASTM D412	325 lbs/in
Elongation	ASTM D412	300% minimum
Hardness - Shore A	ASTM D2240	60 + 10
Tear Strength	ASTM D624	125 lbs min
Water Absorption	ASTM D570	0.1% maximum

Moisture Vapor(perms)	ASTM E96	0.05 perms maximum
Puncture Resistance	ASTM E154	50 lbs minimum
Brittleness	ASTM D746	-75 degrees F

- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Flexible Flashings: 1/16 inch thick EPDM.

2.3 ACCESSORIES

- A. Surface Conditioner: Type specified or acceptable to with membrane manufacturer.
- B. Adhesives: As recommended by membrane manufacturer.
- C. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.
- D. Sealant: As recommended by membrane manufacturer.
- E. Protection Board: Extruded polystyrene rigid insulation specified in Section 07 2113.
- F. Flexible Flashings: 0.50 mils thick, EPDM with tensile strength of 1200 psi, black color as manufactured by approved manufacturers.
- G. Sheet Metal Counterflashings: As specified in Section 07 6200.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify items penetrating surfaces to receive waterproofing are securely installed.
- D. Verify substrate surface slopes to drain for horizontal waterproofing applications.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing. Vacuum horizontal substrates clean.
- C. Do not apply waterproofing to surfaces unacceptable to manufacturer or applicator.

- D. Seal cracks and joints with sealant materials using depth to width ratio in accordance with Section 07 90 00.
- E. Apply surface conditioner at rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

3.3 INSTALLATION - [ADHESIVE BONDED] [SELF ADHERED] MEMBRANE WATERPROOFING

- A. Roll out membrane. Minimize wrinkles and bubbles.
- B. Remove release paper layer. Roll out on substrate with mechanical roller to encourage full contact bond.
- C. Lap sides and ends.
- D. Overlap edges and ends and seal with contact adhesive, minimum 3 inches. Seal permanently waterproof.
- E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- F. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams. Install flexible flashings. Seal watertight to membrane.
- G. Seal membrane and flashings to adjoining surfaces.
- H. Seal items protruding to or penetrating through membrane and install counterflashing membrane material.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test intersections, vertical surfaces and flashings by flooding or hose testing.
- C. When leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect/Engineer; repeat flood test. Repair damage to building.
- D. When area is proven watertight, drain water and remove dam.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit traffic over unprotected or uncovered membrane.

- C. Protect membrane from damage by adhering protection board over membrane surface. Scribe and cut boards around projections and interruptions.

END OF SECTION

SECTION 07 1310

BENTONITE SHEET WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Bentonite sheet membrane waterproofing system for use at foundation walls and related components.
 - 2. Cant strips and other accessories.
 - 3. Protective cover.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 04 2000 – Unit Masonry: Thru wall flashing.
 - 3. Section 04 4200 – Exterior Stone Cladding: Thru wall flashing.
 - 4. Section 07 1300 - Sheet Waterproofing: Miscellaneous tie-ins.
 - 5. Section 07 2113 - Board Insulation: Perimeter and horizontal insulation.
 - 6. Section 07 9000 - Joint Protection.
 - 7. Section 31 2323 - Fill.
 - 8. Section 33 4600 – Subdrainage: Foundation drainage

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
 - 2. ASTM D751 - Standard Test Methods for Coated Fabrics
 - 3. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 4. ASTM D5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

1.3 SYSTEM DESCRIPTION

- A. Waterproofing System: Multi-layer bentonite clay and HDPE membrane capable of preventing moisture migration to interior.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

- C. Product Data: Provide data for membrane, flexible flashings, joint and crack sealants, and others.

- D. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Local / Regional Materials : For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years' experience with projects of similar type and scale.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.

1.9 WARRANTY

- A. Provide to Architect signed copies of the Contractor's and Manufacturer's Warranties.
- B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide ten year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

- D. See Section 01 7000 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 SHEET MEMBRANE WATERPROOFING

- A. Manufacturers:
1. Carlisle Coatings and Waterproofing: CCW MiraClay.
 2. TegraSeal Products; TegraTite Plus.
 3. Tremco: Paraseal LG
 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 MEMBRANE PROPERTIES

- A. Waterproofing Membrane: Composite HDPE/Bentonite membrane comprised of virgin 20 mil HDPE with granular bentonite and a polypropylene non-woven fabric laminated to both sides of the sheet.
1. Minimum Thickness: 250-300 mils with virgin resin 20 mil HDPE and bentonite at 1.5 lbs per sf.
 2. Sheet Width: 42 inch, minimum.
 3. Tensile Strength: 4,000 psi, per ASTM D 412
 4. Ultimate Elongation: 700 percent per ASTM D 412
 5. Resistance to hydrostatic pressure: Minimum 150 feet per ASTM D 751.
 6. Water vapor transmission rate 5 x 10⁻¹² cm/sec per ASTM E96 and D5084.
- B. Seaming Materials: 3 inch (75 mm) wide butyl seam tape as recommended by membrane manufacturer.
- C. Self-Adhering Flexible Flashings: 1/16 inch thick EPDM.
- D. Drainage board: Filter fabric laminated to free-draining high-density dimpled polystyrene drainage core with HDPE backing or alternative as recommended by the waterproofing manufacturer.
- E. Insulation: Rigid extruded polystyrene insulation as specified in Section 07 2113.

2.3 ATTACHMENT MATERIALS

- A. A. Mechanical Fasteners:
1. Case-hardened steel nail with fluted shank having a minimum 1" length and a minimum 1" diameter cap for use on green concrete and masonry substrates.
 2. Powder shot steel pin having a minimum 3/4" diameter washer for use on hardened concrete
 3. and grouted masonry substrates.
 4. Steel staples approved by membrane manufacturer for use according to Project conditions.
 5. Termination Bars: Aluminum; compatible with membrane as recommended by membrane manufacturer.
- B. Adhesive Fasteners:

1. Spray/roll liquid applied rubberized asphalt
2. Spray/roll liquid applied acrylic adhesive
3. Bituminous tape and primer

2.4 ACCESSORIES

- A. Cant: Granular bentonite cant.
- B. Mastic: Compatible mastic as approved by the waterproofing manufacturer.
- C. Water Stop: compatible water stop devices as approved by the waterproofing manufacturer.
- D. Waterpellent: spray covering water.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify that the existing conditions meet the manufacturer's requirements before starting work.
- C. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- D. Verify items penetrating surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's guidelines and instructions.
- B. All concrete shall be cured a minimum of two (2) days and be 1,500-psi in compressive strength before application of bentonite waterproofing system.
- C. Do not apply waterproofing to surfaces unacceptable to manufacturer or applicator.
- D. Seal cracks and joints with sealant materials using depth to width ratio in accordance with Section 07 90 00.
- E. Repair concrete as required providing proper surfaces for the waterproofing. All surfaces shall be free of voids, spalled areas, loose aggregate and sharp protrusions, with no coarse aggregate visible. "Honeycombs" over 3/8-inch in width and 3/8-inch deep shall be plugged with concrete or bentonite mastic and finished flush with surrounding surfaces. Finish shall be relatively smooth.

- F. Provide two (2) inch bentonite cant at all vertical transitions and fill excess space with granular bentonite and/or bentonite mastic for wall pipe penetrations. Refer to manufacturer's recommendations for typical installation guidelines.

3.3 GENERAL INSTALLATION - MEMBRANE

- A. Install membrane waterproofing either vertically or horizontally with bentonite facing the concrete according to manufacturer's recommendations and instructions, including proper substrate preparation, job site considerations and weather restrictions.
- B. Roll out membrane. Minimize wrinkles and bubbles. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- C. Seal joints and seams as recommended by the manufacturer.
- D. Installation of self-adhering flashing membrane a minimum 6" over top edge of waterproofing membrane and continue across foundation wall shelf and up vertical face of wall system as indicated on detailed drawings. This will be installed under section 04 2000 and shall be inspected by and approved by this contractor and become part of the warranted system in this section.

3.4 BACKFILLED WALLS

- A. Concrete Wall/Substrate
 - 1. Remove all sharp protrusions, mud, debris, ice or any other materials that would interfere with membrane performance.
 - 2. Cover any exposed reinforcing steel.
- B. Trowel mastic into all the holes, honeycombs, voids or irregularities that exceed 3/8" in depth.
- C. Penetrations:
 - 1. Fill extra space with granular pack or mastic.
 - 2. Trowel mastic to cover penetration.
 - 3. Cut membrane strip: 6" wide x 2" greater than pipe circumference. Every 1", cut a 3" flanges across the membrane strip.
 - 4. Wrap the strip around the pipe with flanges spreading out on the wall
 - 5. Hold the collar with pipe clamp or seam tape and/or fasteners.
- D. Prepare all expansion joints per manufacture's recommendations.
- E. Install a continuous 2" bentonite cant where wall meets footing.
- F. Install a continuous 1" vertical cant of mastic at all vertical corners prior to installing membrane.
- G. Install membrane from the base of the footing to the grade line with the bentonite side towards the concrete substrate. Securely fasten the membrane every 20" O.C. to the vertical surface just above the footing and to the horizontal surface on top the footing.

- H. Membrane may be installed with a combination of either vertical or horizontal seams.

3.5 INSTALLATION OF DRAINAGE BOARD AND INSULATION

- A. Place protection board, drainage board, and insulation directly against membrane; butt joints. Scribe and cut boards around projections, penetrations, and interruptions. Fasten as recommended by the manufacturer.

3.6 HORIZONTAL SLABS

- A. Concrete Substrate
1. Remove all sharp protrusions, mud, debris, ice or any other materials that would interfere with membrane performance.
 2. Cover any exposed reinforcing steel.
- B. Trowel mastic into all the holes, honeycombs, voids or irregularities that exceed 3/8" in depth.
- C. Penetrations:
1. Fill extra space with granular pack or mastic.
 2. Trowel mastic to cover penetration.
 3. Cut membrane strip: 6" wide x 2" greater than pipe circumference. Every 1", cut a 3" flanges across the membrane strip.
 4. Wrap the strip around the pipe with flanges spreading out on the wall
 5. Hold the collar with pipe clamp or seam tape and/or fasteners.
- D. Use double layer of membrane over construction joints with backfill cover or with pavers.
- E. Install a continuous 2" bentonite cant at vertical / horizontal transitions.
- F. Unroll bentonite membrane on the deck with the bentonite side towards the concrete substrate, starting from the lowest points and moving to the highest points. Overlap and stagger the seams 1-1/2" to 3".
- G. For inside or outside corners:
1. Cut vertical slice in the membrane at the footing and fold overlap in the corner.
 2. Secure with a nails.
- H. Membrane may be installed with a combination of either vertical or horizontal seams.

3.7 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Monitor finishing layer installation and backfill operations to assure no damage is done to the waterproofing membrane.

- C. General Contractor shall advise waterproofing contractor, if a penetration will be made through the applied waterproofing system and take appropriate steps to waterproof such penetration without jeopardizing the warranty at no additional cost to the Owner.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit traffic over unprotected or uncovered membrane.
- C. Protect membrane from damage by adhering insulation board over membrane surface. Scribe and cut boards around projections and interruptions.

END OF SECTION

SECTION 07 1350

INTEGRALLY BONDED SHEET WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pre-applied sheet membrane waterproofing that forms an integral bond to poured concrete for the following applications:
 - 1. Vertical Applications: Provide membrane applied against soil retention system prior to placement of the following concrete foundation walls.
 - a. All elevator and laboratory pit walls.
 - b. Cast in place section of lower steam tunnel walls south of grid 5.
 - 2. Horizontal Applications: Provide membrane applied on prepared subbase prior to placement of the following concrete slabs on grade or footings:
 - a. All elevator and laboratory pit floors.
 - b. Cast in place portion of lower steam tunnel floor south of grid 5.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 1000 – Concrete Forming and Accessories: One sided Forming.
 - 3. Section 03 3000 – Cast in Place Concrete: Vapor Barrier Placement.

1.2 REFERENCES

- A. ASTM International:
 - 1. C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
 - 2. D 412 - Standard Test Methods for Rubber Properties in Tension.
 - 3. D 570 - Standard Test Method for Water Absorption of Plastics.
 - 4. D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - 5. D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - 6. D 3767 - Standard Practice for Rubber - Measurements of Dimensions.
 - 7. D 5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
 - 8. E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - 9. E 154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.3 SYSTEM DESCRIPTION

- A. Waterproofing System capable of preventing moisture migration to interior at pits lower than the Basement floor elevation of 827'-0".

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- C. Product Data: Submit data for membrane including temperature range for application of waterproofing membrane.

1.5 QUALIFICATIONS

- A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.
- B. Installer: A firm that has at least 3 years experience in work of the type required by this section.
- C. Materials: For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.
- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.
- E. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.8 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.

- B. Sheet Membrane Waterproofing: Provide written five-year material warranty issued by the membrane manufacturer upon completion of work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers:
1. Basis of Design: Grace Construction Products.
 2. Substitutions: Under provisions of Section 01 6000.
- B. Pre-applied Integrally Bonded Sheet Waterproofing Membrane:
1. "Preprufe 300R" Membrane for horizontal applications and "Preprufe 160R" Membrane for vertical applications by Grace Construction Products
 2. Composite sheet membrane of high-density polyethylene film, and layers of synthetic adhesive layers.
 3. The membrane shall form an integral and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete.
 4. Provide membrane with the following physical properties:

Property	Test Method	Typical Value
Color		White
Thickness	ASTM D3767, Method A	.046" (12 mm) nominal at horizontal surfaces / .032" (.8mm) nominal at vertical surfaces
Low Temperature Flexibility	ASTM D 1970	Unaffected at -23°C (-10°F)
Elongation	ASTM D 412 Modified	>300%
Crack Cycling at -23°C (-10°F), 100 Cycles	ASTM C 836	Unaffected
Tensile Strength, Film	ASTM D 412	27.6 MPa (4,000 lbs/in. ²) minimum
Peel Adhesion to Concrete	ASTM D 903 Modified	880 N/m (5.0 lbs/in. width)
Resistance to Hydrostatic Head	ASTM D 5385 Modified	70 m (231 ft)
Puncture Resistance	ASTM E 154	990 N (221 lbs) for horizontal surface / 445N (100 lbs) for vertical surface
Permeance	ASTM E 96 Method B	<0.6 ng/m ² sPa (0.01 perms)
Water Absorption	ASTM D 570	<0.5%

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

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- B. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 INSTALLATION, VERTICAL APPLICATIONS

- A. Substrates shall be smooth and sound.
- B. Strictly comply with manufacturer's installation instructions.

3.3 INSTALLATION, HORIZONTAL APPLICATIONS

- A. Earth and stone substrates shall be well compacted to produce an even, solid substrate. Remove loose aggregate or sharp protrusions. Concrete substrates shall be smooth or broom finished and monolithic. Fill gaps or voids greater than 13 mm (0.5 in.). Remove standing water prior to membrane applications.
- B. Strictly comply with manufacturer's installation instructions.

3.4 PROTECTION

- A. Protect membrane in accordance with manufacturer's recommendations until placement of concrete. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 07 1800

TRAFFIC COATINGS (TC-1)

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Waterproof flooring at the following locations:
 - a. Mechanical penthouse at mechanical spaces.
 - b. Top surface of precast over penthouse electrical vault.
 - c. Loading Dock.
 - d. High Bay main floor.
 - e. Refer to Finish Plans for specific locations and extent of flooring.
- B. Related Sections:
 - 1. Section 03 3000 - Cast-in-place concrete: Concrete floor finish.
 - 2. Section 07 9000 - Joint Protection: Joint between traffic membrane and membrane termination.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
 - 2. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - 3. ASTM D1044 - Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
 - 4. ASTM D1360 - Standard Test Method for Fire Retardancy of Paints (Cabinet Method).
 - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 6. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- B. Underwriters Laboratories Inc.:
 - 1. UL - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product characteristics, limitations, and identify dissolving solvents, fuels, and potential destructive compounds.
- C. Samples: Submit two samples of cured membrane, 8 x 10 inch in size illustrating color, surface texture, and variations.

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- D. Manufacturer's Installation Instructions: Include special environmental conditions required to install traffic membrane and potential incompatibilities with adjacent materials.
 - E. Maintenance Data: Include procedures for stain removal, repairing surface, and cleaning.
 - F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 MOCK-UP

- A. Provide mock-up, 10 feet long by 10 feet wide, with membrane system applied to representative substrate.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit procedures for stain removal, repairing surface, and cleaning.
- C. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing installation of traffic membrane, with minimum 5 years of experience. and be approved by the manufacturer for the product and type of application specified.
 - 1. Applicator to provide list of 5 projects of similar scope and coating system configuration, with owner contact names, address and telephone numbers.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Maintain ambient storage temperature of 55 degrees F.

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- C. Keep away from fire or open flame.
 - D. Safety: Refer to all applicable data, including, but not limited to MSDS sheets, PDS sheets, Product labels, and specific instructions for specific personal protection requirements.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install materials when temperature is below 50 degrees F or above 90 degrees F.
- C. Maintain this temperature range, 24 hours before, during and 72 hours after application.
- D. Restrict traffic from area where materials are being installed or are curing.
- E. Proceed with work of this section only when existing and forecasted weather conditions will permit the application to be performed in accordance with the manufacturer's recommendations.

1.10 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Correct defective Work within a ten year period after Date of Substantial Completion.
- C. Provide ten year manufacturer warranty: Provide a copy of written joint and several guarantee, from manufacturer and licensed applicator against defects of materials and workmanship, for a period of up to ten years, beginning with date of substantial completion of system.
 - 1. Include coverage for delamination of system from substrate, degradation of waterproofing ability, and ability to withstand substrate movement of up to 1/32 inch without cracking.

PART 2 PRODUCTS

2.1 WATERPROOF FLOORING (WP-1)

- A. Manufacturers:
 - 1. Carlisle Coatings and Waterproofing.
 - 2. Dex-O-Tex
 - 3. Sonneborn / BASF.
 - 4. Tremco.
 - 5. Substitutions: Section 01 6000 - Product Requirements.
- B. Product:
 - 1. Membrane: Two-component, seamless epoxy based, flexible, waterproof membrane barrier; conforming to the following:

2. Basis of Design: Dex-O-Tex, "Flex-Shield Flooring".
3. Product shall conform to the following:
 - a. Tensile Strength ASTM C307: 1,500 psi
 - b. Tensile Modulus: 17,150 psi
 - c. Tensile Elongation: 96%
 - d. Tear Strength: 120 lb./in.
 - e. Bond Strength (A.C.I. #403): 400 psi (100% concrete failure)
 - f. Surface Hardness ASTM D2240: 55 Shore D
4. Color: Selected from Manufacturer's standard colors.
5. Sealant: Compatible with system and adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate is ready to receive work; surface is clean, dry and free of substances which could affect bond.
- C. Before coating work is commenced, surface shall be inspected and treated as necessary to remove laitance, loose material on the surface, grease, oil and other contaminants which will affect bond of the coating. Surfaces shall be left broom or vacuum clean. Route out cracks, clean, prime, and seal.
- D. Verify that curing methods used for concrete are compatible with coating system.
- E. Metal surfaces shall be dry, clean, free of grease, oil, dirt, rust and corrosion and other coatings and contaminants which could affect bond of coating system, and without sharp edges or offsets at joints.
- F. Commencement of coating installation implies acceptance of substrate area as suitable to accept the pedestrian traffic topping.
- G. Do not begin work until concrete substrate has cured 28 days, minimum, and measured moisture content is not greater than 16 percent .

3.2 PREPARATION

- A. Clean substrate surface free of foreign matter.
- B. Patch concrete substrate with filler to produce surface conducive to bond.
- C. Install cant strips secure at intersecting surfaces.
- D. Protect adjacent surfaces.

3.3 INSTALLATION

- A. Apply system materials.

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- B. Apply primer by brush or trowel to prepared substrate to dry film thickness of [] mils.
 - C. When primer is tack free, apply one base coat of waterproof membrane to total minimum dry film thickness of 30 mil dft.
 - A. When base coat is tack free, fluid apply resin and broadcast aggregate mixture to provide a nominal thickness of 1/8".
 - B. Extend primer and coats up intersecting and perimeter vertical surfaces, 4 inches. Terminate top edge straight.
 - C. Finish to smooth surface, sloped to drains where applicable. Cove at vertical surfaces.
 - D. Apply additional coat of pigmented top coating to desired texture or surface profile.
 - E. Apply sealant to junction of horizontal and intersecting surfaces to achieve watertight seal.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit traffic over unprotected surfaces.

END OF SECTION

SECTION 07 2113

BOARD INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Rigid board insulation at cavity wall construction.
 2. Perimeter foundation wall.
 3. Protection board for waterproofing.
 4. Underside of floor slabs where noted on Drawings.
 5. Rigid board insulation at exterior wall behind stone veneer wall finish.
 6. Rigid board insulation at soffit construction.
 7. Semi rigid board insulation at curtainwall systems.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 07 2116 - Blanket Insulation.
 3. Section 07 2600 - Vapor Retarders: Vapor retarder materials adjacent to insulation.

1.2 REFERENCES

- A. ASTM International:
1. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block.
 2. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
 3. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 4. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 5. ASTM C1289 - Standard Specification for Faced Rigid Cellular Thermal Insulation Board.
 6. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
 7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 8. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.
- B. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on product characteristics, performance criteria, and limitations.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content. For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials. For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
 - 1. Foam Plastic Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Insulation Installed in Exposed Locations Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install adhesives when temperature or weather conditions are detrimental to successful installation.

1.7 SEQUENCING

- A. Sequence Work to ensure fireproofing, firestopping, and vapor retarder materials are in place before beginning Work of this section.

1.8 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with Section 07 2600 for installation of vapor retarder.

PART 2 PRODUCTS

2.1 BOARD INSULATION

- A. Polystyrene Manufacturers:
 - 1. DiversiFoam Products - Extruded-Polystyrene Insulation.
 - 2. Dow Chemical – Extruded Polystyrene Insulation.
 - 3. Tenneco Foam Products - Extruded-Polystyrene Insulation.
 - 4. Owens Corning - Extruded-Polystyrene Insulation.
- B. Polyisocyanurate Manufacturers:
 - 1. Dow Chemical Company.
 - 2. Insulation Corporation of America.NRG Barriers/Johns Manville - Polyisocyanurate Insulation.
 - 3. Rmax - Polyisocyanurate Insulation.
- C. Semi Rigid Mineral Fiber Manufacturers:
 - 1. Thermafiber.
- D. Substitutions: Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Insulation Type 2 (Insul-2) Extruded Polystyrene Insulation: ASTM C578; cellular type, conforming to the following:
 - 1. For use at perimeter foundation wall, and underside of floor slabs
 - 2. Board Size: 48 x 96 inch.
 - 3. Board Thickness: 2 inches, unless noted otherwise on Drawings.
 - 4. When used at foundation walls and horizontal applications, provide insulation boards with integral vertical grooves cut in face to assist water drainage.
 - 5. Thermal Resistance: R of 5.0 per inch of thickness.

6. Water Absorption: In accordance with ASTM D2842, 0.3 percent by volume maximum.
 7. Compressive Strength: Minimum 25 psi (Type IV) for wall applications. Minimum 40 psi (Type VI)] for use under floor slabs and other horizontal applications requiring a higher compressive strength.
 8. Board Edges: Shiplap edges.
 9. Flame Spread Index: Maximum 75 in accordance with ASTM E84.
 10. Smoke Development Index: Maximum 450 in accordance with ASTM E84.
 11. Required Recycled content: Minimum 9 percent total recycled content.
- B. Insulation Type 3 (Insul-3) Polyisocyanurate Insulation: ASTM C1289, rigid board, glass fiber reinforced type, conforming to the following:
1. For use in masonry cavity wall construction, cavity wall construction at structural precast wall panels, and exterior wall behind stone cladding wall finish.
 2. Board Size: 48 x 96 inches.
 3. Board Thickness: Varies – refer to drawings.
 4. Facing: Factory applied skin of reflective aluminum foil on one face, non-reflective foil other face.
 5. Compressive Strength: Minimum 25 psi.
 6. Thermal Resistance: Minimum aged R-value of 6.1 per inch.
 7. Board Edges: ship lapped.
 8. Water Absorption: In accordance with ASTM DC209, less than 0.05 percent by volume maximum.
 9. Flame Spread Index: Maximum 25 in accordance with ASTM E84 based on tests performed on unfaced core on thicknesses up to 4 inches.
 10. Smoke Development Index: Maximum 450 in accordance with ASTM E84 based on tests performed on unfaced core on thicknesses up to 4 inches.
- C. Insulation Type 4 (Insul-4) Mineral Fiber Board Insulation: Slag-wool-fiber/rock-wool-fiber board insulation: ASTM C 612, passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:
1. For use at curtainwall and slab edges for firestopping.
 2. Product: Thermafiber FireSpan 90: Nominal density of 8 lb/cu. ft., Types IA and IB.
 3. Thermal Resistance: Minimum aged R-value of 4.0 of thickness.
 4. Facing:
 - a. Unfaced when used for fire safing.
 - b. Faced one side with mesh reinforced aluminum foil at curtainwall spandrel locations.
 5. Fiber Color:
 - a. Fiber Color at Fire Safing Applications: Standard color.
 - b. Fiber Color at Spandrel Panels: Dark fiber color.
 6. Flame Spread Index: Maximum 25 in accordance with ASTM E84.
 7. Smoke Development Index: Maximum 0 in accordance with ASTM E84.
 8. Minimum Recycle Content: 70% (Pre-Consumer).

2.3 ACCESSORIES

- A. Adhesive: Type recommended by insulation manufacturer for application.

- B. Sheet Vapor Retarder: Specified in Section 07 2600.
- C. Tape: Bright aluminum self-adhering type; mesh reinforced; 2 inches wide.
- D. Insulation Fasteners: Manufacturer's standard impaling clip of galvanized steel, to be mechanically fastened to surface to receive board insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.
- C. Verify substrate surface is flat, free of honeycomb, fins, irregularities, and materials or substances affecting adhesive bond.

3.2 INSTALLATION - FOUNDATION PERIMETER

- A. Adhere 4-inch wide strip of polyethylene sheet over construction joints with double beads of adhesive each side of joint.
 - 1. Tape seal joints.
 - 2. Extend sheet full height of joint.
- B. Apply adhesive in three continuous beads per board length.
- C. Install insulation boards on foundation wall vertically.
 - 1. Place boards in method to maximize contact bedding.
 - 2. Stagger side joints.
 - 3. Butt edges and ends tight to adjacent board and to protrusions.
- D. Extend boards over control joints, unbonded to foundation 6 inches either side of joint.
- E. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
- F. Immediately following application of board insulation, backfill foundation walls to protect insulation.
- G. Immediately following application of board insulation, place protective boards over exposed insulation surfaces, and apply adhesive in five continuous beads per board length.
 - 1. Install boards horizontally from base of foundation to top of insulation.
 - 2. Butt board joints tight; stagger from insulation joints.

3.3 INSTALLATION - EXTERIOR WALLS

- A. Adhere 4-inch wide strip of polyethylene sheet over construction joints with double beads of adhesive each side of joint.
 - 1. Tape seal joints.
 - 2. Extend sheet full height of joint.
- B. Apply adhesive in three continuous beads per board. Daub adhesive tight to protrusions.
- C. Install boards on wall surface vertically. Place membrane surface of insulation against adhesive.
- D. Place boards in method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.
- E. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
- F. Tape insulation board joints.

3.4 INSTALLATION - CAVITY WALLS

- A. Secure impale fasteners to substrate at frequency of 24 inches on center.
- B. Adhere a 4-inch (100 mm) wide strip of polyethylene sheet over control joint with double beads of adhesive each side of joints. Tape seal joints between sheets. Extend sheet full height of joint.
- C. Apply in three continuous beads per board length. Daub adhesive tight to protrusions to ensure continuity of vapor retarder and air seal.
- D. Install boards horizontally between wall reinforcement.
- E. Place membrane surface facing out, tape seal board joints.
- F. Place boards in method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and no protrusions. [Place impale fastener locking discs].
- G. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
- H. Place 4 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and doorframes. Tape seal in place to ensure continuity of vapor retarder.

3.5 INSTALLATION - UNDER CONCRETE SLABS

- A. Provide insulation boards under concrete slabs on grade for a minimum horizontal distance of six (6) feet (1800 mm) from outside edge at perimeter locations where exterior grade is less than two (2) feet above the elevation of the interior slab.

- B. Place insulation boards under slabs on grade after base for slab has been compacted.
- C. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
- D. Prevent insulation from being displaced or damaged while [placing vapor retarder and] placing slab.

3.6 INSTALLATION - CURTAIN WALLS - SEMI-RIGID BOARD INSULATION

- A. Install insulation fasteners per manufacturers' recommendations.
- B. Install board insulation on curtain wall surface and install retaining clips. Place membrane surface of insulation towards building interior.
- C. Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.
- D. Cut and fit insulation tight to protrusions or interruptions to the insulation plane.
- E. Tape insulation board joints and insulation fastener punctures through insulation facing.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit damage to insulation prior to covering.

END OF SECTION

SECTION 07 2116

BLANKET INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Batt insulation in exterior wall and soffit construction.
 - 2. Batt insulation for filling perimeter window and door shim spaces, crevices in exterior wall and roof.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 07 2113 - Board Insulation.
 - 3. Section 07 2600 - Vapor Retarders: Vapor retarder materials adjacent to insulation.
 - 4. Section 07 8400 - Firestopping.
 - 5. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - 4. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.
- B. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on product characteristics, performance criteria and limitations.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content. For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.

1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials. For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.5 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
1. Batt Insulation: Maximum 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Insulation Installed in Exposed Locations Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with Section 07 2600 for installation of vapor.

PART 2 PRODUCTS

2.1 BATT INSULATION

- A. Manufacturers:
1. CertainTeed Insulation.
 2. Johns Manville.
 3. Knauf Fiber Glass.
 4. Owens Corning Fiberglas.
 5. Fibrex, Inc.

6. U.S. Gypsum Co. Thermafiber LLC.
7. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Insulation Type 5 (Insul-5) Batt Insulation: ASTM C665; preformed glass fiber batt; friction fit, conforming to the following:
 1. Thermal Resistance: Minimum R-value of 11 for a 3 ½" thick batt.
 2. Batt Size: As shown on Drawings..
 3. Facing: Unfaced.
- B. Staples: Steel wire; galvanized; type and size to suit application.
- C. Tape: Bright aluminum, mesh reinforced, 2 inch wide.
- D. Insulation Fasteners: Steel impale spindle and clip on flat metal base, self adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

- A. Install in exterior wall, and ceiling spaces without gaps or voids. Do not compress insulation.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

END OF SECTION

SECTION 07 2119

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Foamed-in-place insulation over inside face of sheathing and studs within framed walls at clean room exterior.
 - 2. Sprayed cellulose thermal barrier for application over unprotected foamed in place insulation.
 - 3. Low expansion detailing foam insulation for limited use in wall cavities and around windows and to seal miscellaneous (non-rated) openings.
- B. Related Sections:
 - 1. Section 07 2600 - Vapor Retarders.
 - 2. Section 07 5113 – Asphalt Roofing: Roof insulation.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 2. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
 - 3. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 4. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - 5. ASTM D2482 - Standard Test Method for Surface Strength of Paper (Wax Pick Method).
 - 6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 7. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- B. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to applicable building code for flame spread and smoke developed, concealment, and over coat requirements.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product description, insulation properties, preparation requirements, and overcoat properties.
- C. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
 - 1. Foam Plastic Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
 - 2. Overcoat: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic component.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience, and with service facilities within 100 miles of project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install insulation when ambient temperature is lower than 70 degrees F.

PART 2 PRODUCTS

2.1 FOAMED-IN-PLACE INSULATION (INSUL - 1)

- A. Manufacturers:
 - 1. Insta-Foam Products.
 - 2. BASF: Walltite 158
 - 3. Dow Chemical: Styrofoam Spray Polyurethane Foam Insulation
 - 4. International Cellulose Corporation: Ure-k (for thermal barrier product).
 - 5. Substitutions: Section 01 6000 - Product Requirements.
- B. Material:

1. Insulation: Two component closed-cell polyurethane foam system.
 - a. R value: Minimum 6.5 per inch.
 - b. Water Vapor Transmission: ASTM E96; 1.4 perms at 1 inch thickness.
 - c. Water Absorption: ASTM D2842; 0.60 percent by volume.
 - d. Compressive Strength: ASTM D1621; 26 +/- psi.
 - e. Density: ASTM D1622; 2.0 to 2.3 pcf at 2" lifts.
 - f. Surface Burning Characteristics:
 - 1) Flame Spread Index: ASTM E84; Less than 25.
 - 2) Smoke Developed Index: ASTM E84; Less than 350.

2.2 THERMAL BARRIER

- A. Sprayed cellulose thermal barrier insulation used to cover unprotected, exposed to view spray foam insulation. (Note: where foam insulation is covered by rated gypsum board barrier, this is not required).
- B. Product: Ure-K Thermal Barrier System
 1. Color shall be from Manufacturer's standard color chart.
 2. R-Value shall be 3.6 per inch per ASTM C 518.
 3. Bond strength shall be greater than 100 psf per ASTM E736.
 4. Product shall be Class 1 Class A per ASTM E 84/ UL 723.
 5. Tested in accordance with UBC 26-2 Test Method for the evaluation of Thermal Barriers (ASTM E 119).
 6. NRC to be 0.80 @ 1.25" thick per ASTM E 1042.
 7. Pass Full – Scale Corner Test.
 8. Substitutions: Under provisions of 01 1600.

2.3 LOW EXPANSION DETAILING FOAM (INSUL – 7)

- A. Two-component urethane foam with low-expansion pressure, 10 percent flexibility, and 1.75 to 2.0 lb/cu. ft., suitable for installation adjacent to fenestration. Provide product complying with AAMA 812.
- B. Products: Subject to compliance with requirements, provide one of the following:
 1. Dow Chemical; Froth Pak.
 2. Hilti: CF 116 Filler Foam.
 3. Zerodraft Products, Inc.; Zero Draft Foam Sealant.
 4. Insulation Corporation of America: ICA-Foamfil.
 5. Substitutions: Under provisions of 01 1600.
- C. Material:
 1. Insulation: Two component, quick cure closed-cell polyurethane foam system.
 - a. R value: 4.6 per inch.
 - b. Water Vapor Transmission: ASTM E96; 1.06 perms at 1 inch thickness.
 - c. Water Absorption: ASTM D2842; 1.1 percent by volume.
 - d. Compressive Strength: ASTM D1621; 31.8 +/- psi.
 - e. Density: ASTM D1622; 2.0 at 2" lifts.
 - f. Surface Burning Characteristics:
 - 1) Flame Spread Index: ASTM E84; Less than 25.
 - 2) Smoke Developed Index: ASTM E84; Less than 450.

2.4 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify Work within construction spaces or crevices are complete prior to insulation application.
- C. Verify surfaces are clean, dry, and free of matter capable of inhibiting insulation or overcoat adhesion.

3.2 PREPARATION

- A. Provide masking, drop cloths or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.
- B. Coordinate installation of the sprayed cellulose fiber with work of other trades.
- C. Prime surfaces as required by manufacturer's instructions or as determined by examination..

3.3 INSTALLATION

- A. Apply insulation by spray method, to uniform monolithic density without voids.
- B. At exterior stud walls, apply to back side of exterior sheathing and side edges of studs within wall to a minimum cured thickness of 1 inch. Insulation shall overlap edges of studs to provide monolithic seal of exterior wall.
- C. Apply overcoat monolithically, without voids to fully cover foam insulation, to achieve fire rating required.
- D. Apply detailing foam as required to fill cavities, penetrations and cracks for air sealing, insulation, and sound damping,
- E. Patch damaged areas.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspection will include verification of insulation and overcoat thickness and density.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit subsequent construction Work to disturb applied insulation.

END OF SECTION

SECTION 07 2400

EXTERIOR FINISH SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes direct applied, exterior finish system consisting of a reinforced base and a textured finish applied directly to exterior sheathing.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 4000 – Cold Formed Metal Framing: Exterior sheathing.
 - 3. Section 07 2113 – Board Insulation: Rigid Insulation
 - 4. Section 07 2600 – Vapor Retarders: Vapor Retarder application.
 - 5. Section 07 9000 – Joint Protection: Sealant.
 - 6. Section 09 2113 – Gypsum Board Assemblies: Accessories.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2007a.
 - 2. ASTM C 1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems; 2005.
 - 3. ASTM D 968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2005.
 - 4. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2002.
 - 5. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000 (Reapproved 2005).
 - 6. ASTM E 2485 - Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems () and Water Resistive Barrier Coatings; 2006.
 - 7. ASTM G 153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2004.
 - 8. ASTM G 155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2005a.
- B. NFPA
 - 1. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2007.
 - 2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2006.

1.3 DESIGN REQUIREMENTS

- A. Design for maximum allowable system deflection, normal to the plane of the soffit, of $L/360$.
- B. Design for wind load in conformance with code requirements.
- C. Prevent the accumulation of water behind the finish system, either by condensation in the soffit or leakage through other components of construction, by proper design and detailing of the soffit and related construction.
- D. Provide minimum 1/2 inch wide expansion joints in the system where they exist in the substrate or supporting construction, where shown on Drawings, and where the system adjoins dissimilar construction or materials.
- E. Provide minimum 1/4 inch (6 mm) wide perimeter sealant joints at penetrations through the system (lights, vents, etc.).
- F. Provide compatible backer rod and sealant, or suitable accessories for system terminations or joints.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.
- C. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.
- D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.
- E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.
- F. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

1.5 QUALITY ASSURANCE

- A. EFS Manufacturer Qualifications: Provide all EFS products other than insulation from the same manufacturer with qualifications as follows:
 - 1. Manufacturer of EFS products for not less than 5 years.
 - 2. Manufacturing facilities ISO 9001 certified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.
- B. Storage: Protect adhesives and finish materials from freezing and temperatures in excess of 90 degrees F.
 - 1. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
 - 2. Protect insulation materials from exposure to sunlight.

1.7 ENVIRONMENTAL CONDITIONS

- A. Do not prepare materials or apply EFS during inclement weather unless areas of installation are protected. Protect installed EFS areas from inclement weather until dry.
- B. Do not install coatings or sealants when ambient temperature is below 40 degrees F.
- C. Do not leave installed insulation board exposed to sunlight for extended periods of time.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Master Wall Inc; Product "Soffit System":
- B. STO Corp; Product "Quick Gold Direct Applied Finish System".
- C. Stuco-O-Flex; Product "Perm-Flex Assembly"
- D. Total Wall; Product "Direct Applied Exterior Finish System".
- E. Substitutions: See Section 016000 - Product Requirements.

2.2 EXTERIOR FINISH SYSTEM

- A. Exterior Finish System: Barrier type; reinforced finish coating adhesive-applied direct to substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate in tested samples.
- B. Fire Characteristics:
 - 1. Flammability: Pass, when tested in accordance with NFPA 285.
 - 2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
- C. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance

with ASTM B 117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.

- D. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ASTM E 2485.
- E. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G 153 Cycle 1 or ASTM G 155 Cycle 1, 5, or 9.
- F. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D 2247.
- G. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D 3273.
- H. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D 968 with 500 liters of sand.

2.3 MATERIALS

- A. Primer: Manufacturer's recommended smooth, tinted primer.
- B. Base Coat: Fiber-reinforced, acrylic or polymer-based high build product compatible with reinforcing mesh.
- C. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
 - 1. Texture: Medium.
 - 2. Color: Dark Grey. To be selected from manufacturer's standard colors.
- D. Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.

2.4 ACCESSORY MATERIALS

- A. Exterior Sheathing: Minimum 1/2 inch (13 mm) thick Glass Mat Faced Gypsum Board complying with ASTM C 1177.
- B. Perimeter Edge Trim: Provide the following:
 - 1. At interface with curtainwall, provide Fry Reglet 5/8" deep x 1/2" wide 'F' type reveal, #DRMF-625-50.
 - 2. At interface with aluminum edging, provide Fry Reglet 5/8" deep x 1/2" wide 'Z' type reveal, #DRMZ-625-50
 - 3. Finish: clear anodized

- C. Corner bead, casing bead, starter track, expansion and control joint accessories in galvanized steel. All accessories shall meet the requirements of ASTM C 1063 and its referenced documents.
- D. Sealant Materials: As recommended by EFS manufacturer.

PART 3 EXECUTION

3.1 GENERAL

- A. Install in accordance with EFS manufacturer's instructions and ASTM C 1397.
- B. Where different requirements appear in either document, comply with the most stringent.
- C. Neither of these documents supercedes the provisions of the Contract Documents that define the contractual relationships between the parties or the scope of work.

3.2 EXAMINATION

- A. Verify that substrate is sound and free of oil, loose materials, or protrusions that could interfere with EFS installation and is of a type and construction that is acceptable to EFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.
- B. If gypsum sheathing has been exposed to weather for more than 30 days, check for integrity of surface using method specified in ASTM C 1397 Annex A2, at minimum of two locations or once every 5000 sq ft, whichever is greater; if any test fails, notify Architect and do not begin installation.
- C. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

3.3 SURFACE PREPARATION

- A. Replace weather damaged sheathing and repair damaged or cracked surfaces.
- B. Level surfaces to comply with required tolerances.

3.4 INSTALLATION – FINISH SYSTEM

- A. Install over sheathing board. See Section 05 4000.
- B. Install reveal trim per manufacturer's recommendations, with mudded in flanges.
- C. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at all terminations of the EFS. Install reinforcing fabric as recommended by EFS manufacturer.
 - 1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
 - 2. Allow base coat to dry a minimum of 24 hours before next coating application.

-
- D. Apply finish directly over the base coat (or primed base coat) only after the base coat/primer has thoroughly dried. Apply the finish by spraying, or troweling with a stainless steel trowel, depending on finish specified.
1. Avoid application in direct sunlight.
 2. Apply finish in a continuous application, always working to a wet edge.
 3. Adjust scheduling of work to account for hot or dry weather conditions in order to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
 4. Do not install finish on accessories.
 5. Do not install separate batches of finish side by side.
 6. Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the project specifications.
- E. Apply sealant at all open perimeter and expansion joints in accordance with Section 07 9000.

END OF SECTION

SECTION 07 2600

VAPOR RETARDERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Spray-on membrane for controlling air and vapor diffusion through walls (primary system).
 - 2. Self-adhering sheet materials for controlling vapor diffusion through walls (secondary system where noted on Drawings).
 - 3. Poly vapor retarder at Clean room interior wall.
- B. Related Sections
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 – Cast in Place Concrete: Under slab vapor barrier.
 - 3. Section 04 4200 – Unit Masonry Assemblies: Through wall flashing.
 - 4. Section 07 1350 – Integrally Bonded Sheet Waterproofing; Vapor barrier at pits.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- B. Sealant, Waterproofing and Restoration Institute:
 - 1. SWRI - Sealant Specification.

1.3 PERFORMANCE REQUIREMENTS

- A. Spray-on Membrane Air and Vapor Retarder: Provide an air and vapor barrier system to perform as a continuous barrier to air infiltration/exfiltration and water vapor transmission and to act as a liquid water drainage plane flashed to discharge any incidental condensation or water penetration.
 - 1. Spray-on membrane Vapor Retarder Permeance: Less than 0.08 perms when tested in accordance with ASTM E96, Procedure B.
- B. Adhered Sheet Vapor Retarder: Vapor Retarder Permeance: Less than .05 perms when tested in accordance with ASTM E96, Procedure B.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data indicating material characteristics, performance criteria and limitations.

- C. Manufacturer's Installation Instructions: Submit preparation and installation requirements, techniques.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post-consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SWRI - Sealant and Caulking Guide Specification requirements for materials and installation.

1.7 SEQUENCING

- A. Section 01 1000 - Summary: Work sequence.
- B. Sequence Work to permit installation of materials in conjunction with other retardant materials and seals.
- C. Do not install vapor retarder until items penetrating vapor retarder are in place.

PART 2 PRODUCTS

2.1 SPRAY-ON MEMBRANE AIR AND VAPOR RETARDER

- A. Acceptable Manufacturers:
 - 1. Grace Construction Products; "Perm-A-Barrier Liquid".
 - 2. Carlisle Coatings and Waterproofing; "Barriseal".
 - 3. Tremco Incorporated; "ExoAir"
 - 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 SPRAY-ON MEMBRANE AIR AND VAPOR RETARDER SYSTEM COMPONENTS

- A. Membrane Air and Vapor Retarder: Two part, spray applied, self-curing, synthetic rubber based material free of solvents, isocyanates and bitumen. Cured thickness of 1.5 mm (0.060 in.) nominal. For use at exterior walls.
 - 1. Water Vapor Permeance (ASTM E96, Method BW): Less than 0.08 perms
 - 2. Air Permeance (ASTM E283-91): 0.00012 cfm/sq. ft.
 - 3. Elongation Capability (ASTM A412): 500 percent minimum.
 - 4. Service Temperature Range: -40 to 180 degrees F.
- B. Primer: Water-based primer as recommended by membrane manufacturer to provide a high tack finish on the treated substrate where required.
- C. Transition Tape: 0.9 mm of self-adhesive rubberized asphalt integrally bonded to 0.1 mm of cross-laminated, high-density polyethylene film to provide a min. 0.1 mm thick membrane.
- D. Flexible Wall Flashing: 0.8 mm of self-adhesive rubberized asphalt integrally bonded to 0.2 mm of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm thick membrane.
- E. Sealant: Type specified in Section 07 9000.
- F. Primer and Backer Rods: Recommended by sealant manufacturer to suit application.

2.3 SELF-ADHERED MEMBRANE AIR AND VAPOR RETARDER SYSTEM COMPONENTS

- A. Acceptable Manufacturers:
 - 1. Carlisle Coatings and Waterproofing; "CCW 705".
 - 2. Grace Construction Products; "Perm-A-Barrier Wall Membrane".
 - 3. Henry Company; "Blueskin SA"
 - 4. Tremco Incorporated; "ExoAir".
 - 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Membrane Air and Vapor Retarder: Min. (.040 in) thick membrane comprised of 0.9 mm (0.036 in) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (.004 in) of cross-laminated, high-density polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed. For use at exterior wall details where noted on Drawings.
 - 1. Water Vapor Permeance (ASTM E96, Method BW): Less than 0.05 perms
 - 2. Air Permeance (ASTM E2178): Less than 0.0002 cfm/sq. ft.

3. Elongation Capability (ASTM D412): 200 percent minimum.
 4. Tensile Strength (ASTM D412): Minimum 400 psi.
 5. Service Temperature Range: -25 to 145 degrees F.
- C. Primer: Water-based primer as recommended by membrane manufacturer to provide a high tack finish on the treated substrate where required.
- D. Transition Tape: 0.9 mm of self-adhesive rubberized asphalt integrally bonded to 0.1 mm of cross-laminated, high-density polyethylene film to provide a min. 0.1 mm thick membrane.
- E. Flexible Wall Flashing: 0.8 mm of self-adhesive rubberized asphalt integrally bonded to 0.2 mm of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm thick membrane.
- F. Sealant: Two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/l max. VOC Content.
- G. Primer and Backer Rods: Recommended by sealant manufacturer to suit application.

2.4 SHEET VAPOR RETARDERS

- A. Acceptable Manufacturers:
1. Alumiseal Corp.
 2. Fiberweb Corp.
 3. Fortifiber Corp.
 4. Griffolyn, Reef Industries.
 5. Lamtec Corp.
 6. Raven Industries.
 7. Stego Industries
 8. Substitutions: Under provisions of Section 01 1600 - Product Requirements.

2.5 SHEET VAPOR RETARDER COMPONENTS

- A. Sheet Retarder: Clear, reinforced polyethylene film; 10 mil thick. For use in interior wall assembly at the Clean Room. Refer to Drawings for locations.
1. Product to be Griffolyn Type-65, or equivalent by acceptable manufacturer.
 2. Description: 3 Ply laminate with two layers high-density polyethylene and high strength core grid.
 3. Permeance Rating: Less than 0.04 perms.
 4. Tensile strength: Minimum 100 lb/ft.
- B. Primer and Backer Rods: Recommended by sealant manufacturer to suit application.
- C. Tape: Polyethylene self-adhering type, mesh reinforced, 2 inch wide, compatible with sheet material.
- D. Sealant: Type specified in Section 07 9000.
- E. Primer and Backer Rods: Recommended by sealant manufacturer to suit application.

- F. Cleaner: Non-corrosive type; recommended by sealant manufacturer; compatible with adjacent materials.
- G. Adhesive: Compatible with sheet retarder and substrate, permanently non-curing.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove loose or foreign matter capable of impairing adhesion.
- B. Clean and prime substrate surfaces to receive [adhesive] [and] [sealants].

3.2 EXISTING WORK

- A. Clean and repair existing construction to provide positive and continuous seal for vapor retarders.

3.3 INSTALLATION – SPRAY-ON MEMBRANE

- A. Application of Fluid Applied Membrane
 1. Spray or trowel apply a continuous uniform film at min. 60 mils (1.5 mm or .060 in.) dry film thickness using multiple, overlapping passes.
 2. When spraying use a cross-hatching technique (alternating horizontal and vertical passes) to ensure even thickness and coverage. Use spray equipment approved by material manufacturer.
 3. Carry membrane into any openings a minimum of 50mm (2 in.).
 4. Seal all brick-ties and other penetrations as work progresses.
- B. Application of Transition Membrane
 1. After membrane has cured, apply transition membrane with a minimum overlap of 75mm (3 in.) onto each surface at all beams, columns and joints as indicated in detail drawings.
 2. Tie in to window and doorframes, spandrel panels, roof and floor intersections and changes in substrate.
 3. Overlap adjacent pieces 50 mm (2 in.) and roll all seams with a hand roller.
 4. Seal top edge of flashing with termination mastic.
 5. If transition flashing is pre-installed prior to application of membrane, apply transition flashing as above. Spray or trowel a continuous uniform film of Fluid Membrane at min. 60 mils dry film thickness using multiple, overlapping passes, with a minimum overlap of 3 inches onto transition flashing. For sill condition, spray or trowel membrane onto pre-installed sill flashing and onto horizontal section of sill.
- C. Application of Flexible Membrane Wall Flashing
 1. Precut pieces of flashing to easily handled lengths for each location.
 2. Fully adhere flashing to substrate to prevent water from migrating under flashing.
 3. Overlap adjacent pieces 2 in. and roll all seams with a hand roller.

4. Trim bottom edge 1/2 in. back from exposed face of the wall. Flashing shall not be permanently exposed to sunlight.
5. At heads, sills and all flashing terminations, turn up ends a minimum of 2 in. and make careful folds to form an end dam, with the seams sealed.
6. Seal top edge of flashing with termination mastic.
7. Do not allow the rubberized asphalt surface of the flashing membrane to come in contact with poly-sulfide sealants, creosote, uncured coal tar products or EPDM.

3.4 INSTALLATION – SHEET MEMBRANE

- A. Vapor Retarder For Stud Framed Walls: Secure sheet retarder to stud faces with adhesive. Lap edges over stud faces, lap ends onto adjacent construction; caulk ends with sealant to ensure complete seal.
- B. Vapor Retarder Seal For Openings: Install sheet retarder between window and door frames and adjacent vapor retarder and seal with continuous sealant. Caulk with sealant to ensure complete seal. Position laps over firm bearing.
- C. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.

3.5 PROTECTION AND CLEANING – SPRAY-ON MEMBRANE

- A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.
- B. Membrane is not suitable for permanent exposure and should be protected from the effects of sunlight.
- C. Schedule work to ensure that the membrane system is covered as soon as possible after installation. Protect system from damage during subsequent operations. If the system cannot be covered within 60 days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.
- D. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.

3.6 SCHEDULES

- A. Masonry Veneer Cavity Walls: Spray-on membrane air and vapor retarder applied to concrete wall backup.
- B. Masonry or Stone Veneer Cavity Walls: Spray-on membrane air and vapor retarder applied to exterior sheathing over cold-formed metal stud wall backup.
- C. Metal Siding over Concrete or Masonry Walls: Spray-on membrane air and vapor retarder applied to concrete masonry unit wall backup.

- D. Soffits: Spray-on membrane air and vapor retarder applied where noted on drawings.
- E. Interior wall partitions: Sheet vapor retarder.

END OF SECTION

SECTION 07 4213

METAL WALL PANELS (MWP-1)

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes preformed metal siding system:
 - 1. For use at Exterior Gas Storage yard walls and soffits, and Stair 2 walls above roof.
 - 2. Related flashings and accessory components.

- B. Related Sections:
 - 1. Section 05 4000 - Cold-Formed Metal Framing: Stud wall framing system.
 - 2. Section 07 2113 - Board Insulation.
 - 3. Section 07 2116 - Blanket Insulation.
 - 4. Section 07 2600 - Vapor Retarders.
 - 5. Section 07 4243 - Composite Wall Panels: MWP-3 insulated metal panels at hangar door and MWP-4 aluminum composite panels.
 - 6. Section 07 6200 - Sheet Metal Flashing and Trim Section

1.2 REFERENCES

- A. American Society of Civil Engineers:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

- B. ASTM International:
 - 1. ASTM A606 - Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - 2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 4. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 5. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 6. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 7. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 8. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.

1.3 SYSTEM DESCRIPTION

- A. System: Preformed and prefinished metal siding system of horizontal profile; site assembled.

1.4 PERFORMANCE REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
 - 1. Design Pressure: Minimum 30 lb/sq ft.
- B. Maximum Allowable Deflection of Panel: 1/180 of span.
- C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- E. Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials.
- F. Vapor Retarder: Provide continuity of vapor retarder at building enclosure elements in conjunction with vapor retarders specified in Section 07 2600.

1.5 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.
- C. Product Data: Submit data on panels.
- D. Samples: Submit three samples of siding and siding finish, 12 x 12 inch in size illustrating finish color, sheen, and texture.
- E. Manufacturer's Installation Instructions: Submit special procedures.

1.6 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Insulation: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation material.

1.7 QUALIFICATIONS

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

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- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store prefabricated material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials capable of causing discoloration or staining.

1.9 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work for installation of vapor retarder.
- C. Coordinate Work with installation of windows and adjacent components or materials.

1.10 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for metal siding.

PART 2 PRODUCTS

2.1 MANUFACTURED METAL PANELS (MWP-1)

- A. Acceptable Manufacturers:
 - 1. Centria.
 - 2. Firestone Metal Products / Unaclad.
 - 3. Morin
 - 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 WALL PANEL SYSTEM

- A. Basis of Design: Drawing Designation MWP-1.
 - 1. Centria IW Series; System Number IW-13A
 - a. Interlocking panels with ribbed profile and concealed fasteners.
 - b. Panel Depth: 1-1/2 inch.
 - c. Panel Width: 12 inches.
 - d. Panel Length: Maximum length possible to minimize joints in wall surface.
 - e. Surface Finish: Smooth

- f. For use at walls and soffit where indicated on Drawings.

2.3 COMPONENTS

- A. Exterior Panel and Other Sheet Materials: 20 gage thick precoated steel stock.
1. Precoated Galvanized Steel: ASTM A755/A755M; ASTM A924/A924M, Grade D, Coating Designation G90 (Z275)
 2. Exposed Coil-Coated Finish:
 - a. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605, two coat system, with minimum 70 percent polyvinylidene fluoride resin.
 - b. Finish / Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
 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.
 4. Color: Custom color to be determined.
- B. Soffit Panels: To match wall panels.
- C. Insulation: Rigid type as specified in Section 07 2113.
- D. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from exterior wall substrate for thickness of insulation indicated. Attach to substrate with fasteners.
- E. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles. Mitered internal corners to be back braced with 22 gage thick pre-coated sheet stock to maintain continuity of profile.
- F. Trim, Closure Pieces, Caps, Flashings: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- G. Anchors: Galvanized steel.

2.4 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed cell laminated polyethylene; minimum 1-inch- 25-mm- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

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- B. Flashing and Trim: Formed from 0.018-inch 0.46-mm minimum thickness, zinc-coated (galvanized) steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance.
 - 1. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers.
 - 2. Finish flashing and trim with same finish system as adjacent metal wall panels.
 - C. Sealants: Manufacturer's standard type suitable for use with installation of system; color to match siding.
 - D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers. All fasteners to be concealed.
 - E. Field Touch-up Paint: As recommended by panel manufacturer.
 - F. Bituminous Paint: Asphalt base.

2.5 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. 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.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify building framing members are ready to receive panel system.

3.2 PREPARATION

- A. A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

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- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

3.3 INSTALLATION

- A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Section 07 2113 - Board Insulation.
1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches 610 mm o.c. Attach furring members to substrate with screws spaced 24 inches 610 mm o.c.
 2. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.
- B. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 2. Use concealed fasteners unless otherwise approved by Architect/Engineer.
 3. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 4. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
 5. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
 6. Locate joints over supports. At panel splices, nest panels with minimum 2-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- C. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from substrate for thickness of insulation indicated.
- D. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. 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.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.

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- B. Maximum Offset From Indicated Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
 - C. Maximum Variation from Plane or Location Indicated on Drawings: 1/8 inch.

3.5 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove site cuttings from finish surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 4243

COMPOSITE WALL PANEL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
1. Preformed insulated metal panel system at High Bay hangar door (MWP-3)
 2. Preformed un-insulated composite metal panel system for exterior and interior application. (MWP-4).
 3. Related sealant and accessory components.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 03 1000 - Concrete Forming and Accessories: Execution requirements for anchors in concrete work for attachment of panel components specified by this section.
 3. Section 05 1200 - Structural Steel Framing: Structural steel building frame.
 4. Section 05 4000 - Cold-Formed Metal Framing: Stud wall framing system.
 5. Section 07 2113 - Board Insulation.
 6. Section 07 2600 - Vapor Retarders.
 7. Section 07 4213 - Metal Wall Panels.
 8. Section 07 9000 - Joint Protection.
 9. Section 08 3500 – Vertical Bi-Fold Hangar Door: Frame to receive metal panels.

1.2 REFERENCES

- A. ASTM International:
1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 4. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 5. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 6. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 7. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 8. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 9. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

10. ASTM D2482 - Standard Test Method for Surface Strength of Paper (Wax Pick Method).
 11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 12. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 13. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 14. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 15. ASTM E413 - Standard Classification for Rating Sound Insulation.
- B. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 2. NFPA 285 - Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
- C. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SYSTEM DESCRIPTION

- A. Insulated Core Metal Wall Panel System (MWP-3): Factory-foamed-in-place horizontal and vertical wall panel system consisting of exterior metal face sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, utilizing no glues or adhesives, with factory sealed tongue-and-groove and pressure-equalized rain screen-designed horizontal joint, attached to supports using concealed fasteners.
- B. Aluminum Composite Panel (MWP-4): Preformed and prefinished composite metal facing panel system of flat profile; shop fabricated and site installed with furred framing/anchorage assembly. Manufacturer's authorized architectural distributor, fabricator and installer must provide composite panel. Contract Documents must be adhered to for acceptance of the panel system.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall, including building corners, As calculated in accordance with ASCE 7 - Calculation of Wind Loads, as measured in accordance with ASTM E330.
- B. Design panel units to withstand dead loads and positive and negative live loads acting normal to plane of wall as calculated in accordance with applicable code to a basic design wind speed of 90 mph (128.8 km/h). Maximum allowable deflection of span: 1/180.
- C. Movement: Accommodate movement within system without damage to system, components, or deterioration of seals; movement between system and perimeter

components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

- D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- E. Tolerances: Accommodate tolerances of building structural framing.

1.5 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Signed and sealed by professional engineer.
 - 1. Indicate dimensions, panel profile and layout, spans, joints, expansion joints, construction details, methods of anchorage, method of installation and interface with adjacent materials.
 - 2. Include design calculations.
 - 3. Design criteria and design loads which are applied to the primary structure, shall be specifically indicated and located on the shop drawings,
- C. Product Data:
 - 1. Submit panel profile characteristics and dimensions, and structural properties.
 - 2. Submit data on assembled panel structural capabilities.
 - 3. For fire resistant rated assemblies, submit data showing assembly rating is maintained.
- D. Samples:
 - 1. Panel Assembly: One sample of each type of assembly, 30 inches x 30 inches minimum, showing method of attachment, all types of fasteners required, concealed and exposed, and gaskets (if any).
 - 2. Two samples each color or finish selected 8 inches x 8 inches minimum illustrating finish color, sheen, and texture.
- E. Submit manufacturer's certificate, under provisions of Section 01 3300, that products and installation meet or exceed specified requirements, including compliance with regulatory requirements.
- F. Manufacturer's Installation Instructions: Submit special handling criteria, installation sequence, and cleaning procedures.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.7 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
1. Composite Panels: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. When possible, take field measurements prior to completion of shop manufacturing and finishing.
- C. Shop fabricate all composite panels. No field fabrication will be allowed. Panels must be fabricated using the envelope pan corner, with back up plate, caulking, and pneumatically applied pop rivets centered on returns.

1.8 QUALIFICATIONS

- A. Composite Panel Manufacturer: Have a minimum of 5 years' continuous experience manufacturing composite panels of the type specified, and capable of providing a list of five projects of similar size, including approximate time of installation and name of the architect for each.
- B. Fabricator/Installer: Must be an approved fabricator for the panel manufacturer with a minimum of five years' experience handling composite panels of this type, project size, and scope.
- C. Design metal panels under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Minnesota

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.

- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store pre-finished material off ground with weather protection to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials capable of causing discoloration or staining.

1.10 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with installation of hangar door.

1.11 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for composite panels.

PART 2 PRODUCTS

2.1 INSULATED COMPOSITE METAL BUILDING PANELS (MWP-3)

- A. Acceptable Manufacturers:
 - 1. Centria.
 - 2. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 UNINSULATED COMPOSITE METAL BUILDING PANELS (MWP-4)

- A. Acceptable Manufacturers:
 - 1. Alpolyc by Mitsubishi Chemical America, Inc.
 - 2. Alucobond by 3A Composites.
 - 3. Reynobond by Alcoa Architectural Products
 - 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.3 WALL PANEL SYSTEM MWP-3

- A. Basis of Design: Centria Formawall Dimension Series; 3" Horizontal Flat panels (FWDS-H).
 - 1. Interlocking panels with concealed fasteners.
 - 2. Panel Depth: 3 inches.
 - 3. Panel Width: 30 inches.
 - 4. Panel Length: To match door width. Refer to Drawings.
 - 5. Surface Finish: Striated
- B. Finish:
 - 1. Exposed aluminum surfaces:

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- a. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605, two coat system, with minimum 70 percent polyvinylidene fluoride resin.
 - b. Finish / Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
 - 2. For use as exterior finish system at High Bay hangar door.
 - C. Insulation for Panel Cores:
 - 1. Metal Panel Foamed-Insulation-Core: Foamed-in-place urethane or isocyanurate containing no
 - 2. CFC or HCFC compounds.
 - a. Density: Minimum 2.7 lb/cu. ft. (43.4 kg/cu. m)
 - b. Shear Strength: Minimum 31 lb/sq. in.
 - c. Compressive Strength: Minimum 32 lb/sq. in.
 - d. Tensile Strength: Minimum 29 lb/sq. in.
 - D. Accessories:
 - 1. Provide complete metal wall panel assembly incorporating trim, copings, and miscellaneous flashings.
 - 2. Provide manufacturer's factory-formed clips, shims, flashings, gaskets, lap tapes, closure strips, and caps for a complete installation.
 - 3. Fabricate accessories in accordance with SMACNA Manual.
 - E. Extrusion Trim: Provide manufacturer-provided extruded trim for the following locations and as indicated on Drawings:
 - 1. Base trim.
 - 2. Coping.
 - 3. Panel installation perimeter.
 - 4. Opening perimeters.
 - F. Sealants: Manufacturer's approved two-part low or medium modulus, pre-pigmented silicone; non-staining, non-shrinking and non-sagging; ultra-violet and ozone resistant; Color to be custom color to match panels.
 - G. Flashing Tape: 4-inch wide self-adhering butyl flashing tape.
 - H. Panel Attachment Clips: Concealed G-90 galvanized steel clip configured to prevent overdriving of fastener and crushing of foam core, with panel fasteners engaging both face and liner elements and mechanically attaching to panel supports. Clip configured also to be utilized without removing significant portions of the foam at each clip location.
 - I. Fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels by factory-applied coating.

2.4 WALL PANEL SYSTEM MWP-4

- A. Basis of Design: Apolic HD for exterior applications and Apolic PE (standard) system for interior applications.

1. Non-insulated Core: Manufacturer's standard thermoplastic material, thermally bonded to aluminum face sheets.
 2. Face Sheets: Aluminum alloy 3105 H14.
 - a. At exterior panels: 0.032 inch thick.
 - b. At interior panels: 0.020 inch thick.
 3. Panel Thickness: 4mm.
 4. Exposed aluminum surfaces:
 - a. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605 three coat system, with minimum 70 percent polyvinylidene fluoride resin.
 - b. Finish / Color: PPG Duranar XL UC51131XL, "Silver".
 5. For use at entries. Refer to Drawings for location and details.
- B. Subgirts: Manufacturer's standard profile; to attach panel system to building members. Thickness as required to support specified loads within specified deflection limitations.
- C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles. Mitered internal corners to be back braced with pre-coated sheet stock to maintain continuity of profile.
- D. Accessories:
 1. Trim, Closure Pieces, Caps, Flashings, Facias and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
 2. Anchors: Stainless steel.
 3. Gaskets: Manufacturer's standard type suitable for use with panel system, permanently resilient; ultraviolet and ozone resistant; color to match siding.
- E. Sealants: Manufacturer's approved two-part low or medium modulus, pre-pigmented silicone; non-staining, non-shrinking and non-sagging; ultra-violet and ozone resistant; Color to be selected from manufacturer's full line of available colors..
- F. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, stainless steel; fastener cap same color as exterior panel.

2.5 FABRICATION

- A. Fabrication of component profiles on site is not permitted.
- B. Form sections to shape indicated on Drawings, accurate in size, square, and free from distortion or defects.
- C. Form pieces in longest practicable lengths.
- D. Panel Profile: Manufacturer's standard profile as indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify building framing members are ready to receive panel system.

3.2 INSTALLATION

- A. Install metal wall panel system in accordance with approved shop drawings and manufacturer's recommendations. Install metal wall panels in orientation, sizes, and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement
- B. Protect panel surfaces in contact with dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Attach panels to metal framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.
- D. Locate panel joints over supports.
- E. Use concealed fasteners wherever possible.
- F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies.

3.3 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Offset From Indicated Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- C. Maximum Variation from Plane or Location Indicated on Drawings: 1/8 inch.

3.4 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.
- C. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.

END OF SECTION

SECTION 07 5113

BUILT-UP ASPHALT ROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Four-ply fiberglass felt BUR with aggregate surfacing set in hot asphalt.
 2. Three-ply fiberglass felt built-up roof (BUR) with a styrene-butadiene-styrene (SBS) modified bituminous cap sheet.
 3. Roof insulation.
 4. Roof vapor retarder.
 5. Roof pavers.
- B. Related Sections:
1. Section 06 1053 - Miscellaneous Rough Carpentry: Wood nailers, sheathing and cants.
 2. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashing and coping.
 3. Section 08 6300 - Metal-Framed Skylights: Skylight frame, counterflashing, and flashing.

1.2 REFERENCES

- A. ASTM International:
1. ASTM C79/C79M - Standard Specification for Gypsum Sheathing Board.
 2. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 3. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
 4. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
 5. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 6. ASTM C726 - Standard Specification for Mineral Fiber Roof Insulation Board.
 7. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board.
 8. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 9. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 10. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 11. ASTM D312 - Standard Specification for Asphalt used in Roofing.
 12. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
 13. ASTM D1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
 14. ASTM D2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

15. ASTM D2626 - Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing.
 16. ASTM D3909 - Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules.
 17. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
 18. ASTM D4601 - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
 19. ASTM D4897 - Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing.
 20. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 21. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 22. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
- B. FM Global:
1. FM DS 1-28 - Wind Loads to Roof Systems and Roof Deck Securement.
 2. FM 4450 - Approval Standard for Class 1 Insulated Steel Deck Roofs.
- C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.
- D. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- E. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.
- F. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 3. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
 4. UL 1256 - Fire Test of Roof Deck Construction.
 5. UL 1897 - Uplift Tests for Roof Covering Systems.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt within a range of plus or minus 25 deg F (14 deg C) measured at the mop cart or mechanical spreader immediately before application.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather

without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

- B. **Material Compatibility:** Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. **Roofing System Design:** Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7. Design wind speed: 70 mph, Exposure C, Importance 1.
- D. **Energy Performance:** Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
- E. **FMG Listing:** Provide built-up roofing, base flashings, and component materials that comply with requirements of FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1.5 SUBMITTALS

- A. **Section 01 3300 - Submittal Procedures:** Submittal procedures.
- B. **Shop Drawings:** For roofing system. Include plans, elevations, sections, details, and attachments to other work. Include project specific details; but, not limited to the following:
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Crickets, saddles, and tapered edge strips, including slopes.
 - 4. Door threshold and flashing.
 - 5. Pipe vent flashing details.
 - 6. Roof membrane saddle flashing.
 - 7. Roof penetrations.
- C. **Product Data:** Submit data indicating membrane and bitumen materials, base flashing materials, insulation, vapor retarder, and protective covering.
- D. **Samples for Verification:** submit three sets of the following products:
 - 1. 12 by 12-inch square of Type IV and Type VI felts.
 - 2. 12 by 12-inch square of each field granule cap ply membrane.
 - 3. 12 by 12-inch square of each base ply flashing membrane.
 - 4. 12 by 12-inch square of each cap ply flashing membrane.
 - 5. 12 by 12-inch square of polyisocyanurate insulation boards.
 - 6. 12 by 12-inch square of cover boards.
 - 7. 1/2 lb of aggregate surfacing material.
- E. **Manufacturer Certificates:** Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of complying with performance requirements.

- F. **Product Test Reports:** Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system. **Product Test Reports:** Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
- G. **Maintenance Data:** For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. **Installer Qualifications:** A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- C. **Source Limitations:** Obtain components including roof insulation, fasteners, filter fabric, cover board, low rise foam adhesive, termination bar, vegetative trays, and sealants from same manufacturer as membrane roofing or as approved by membrane roofing manufacturer.
- D. **Exterior Fire-Test Exposure:** ASTM E 108, Class A for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. **Mockups:** Install roofing membrane and flashing at door threshold to form a membrane door pan to demonstrate surface preparation, thickness of roofing membrane, flashing components and execution quality.
 - 1. If Architect determines mockups do not comply with requirements, reapply roofing until mockups are approved.
 - 2. Mockups maintained in an undisturbed condition may be incorporated into the completed Work.
- F. **Preinstallation Roofing Conference:** Conduct conference at Project site.
 - 1. Meet with University, Architect, University's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- C. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- D. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years' experience.
- B. Applicator: Company specializing in performing Work of this section with minimum ten years' experience approved by manufacturer.

1.9 PROJECT CONDITIONS

- A. Section 01 6000 - Product Requirements.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- C. Wind velocity and temperature limitations shall be based on Contractor's ability to apply materials in the specified manner.
- D. Special precautions are required when ambient temperature is below 40 deg F.

- E. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of material and finishes.
- F. Protect and sequence installation of sheet metal in such a manner to ensure it does not become damaged due to construction activities. Any damaged materials shall be immediately replaced at no additional cost to the Owner.

1.10 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with installation of associated roof penetrations and counterflashings installed by other sections as Work of this section proceeds.

1.11 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
- C. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, vegetation trays and other components of membrane roofing system. The roof manufacturer shall design each roofing system to resist wind uplift for the specific site location in accordance to local building codes.
- D. Warranty Period: Twenty (20) years from date of Substantial Completion.
- E. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, vegetative trays, and walkway products for the following warranty period:

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. **BUR-1:** Firestone (4 Ply Built-Up Roof w/Gravel Surfacing over concrete)
 - 1. Field Assembly (from bottom to top)
 - a. Substrate: Flat concrete deck.
 - b. Primer: ASTM D41.
 - c. Vapor Retarder: 2 Ply (Ply IV) set in hot moppings of type III asphalt.
 - d. Rigid Insulation: Tapered polyisocyanurate insulation adhered with Type III asphalt.

- e. Cover Board: 1" Fiberboard or Perlite (FiberTop) adhered with Type III asphalt.
 - f. Membrane: 4 Ply (Ply VI) set in hot moppings of type III asphalt.
 - g. Surfacing: Flood coat of Type III asphalt and aggregate surfacing set in Type III asphalt.
 - 2. Basewall flashing assembly:
 - a. Substrate: Plywood;
 - b. Backer ply: Two plies (Ply VI) set in hot moppings of type III asphalt.
 - c. Cap flashing ply: SBS Premium set in hot moppings of type III asphalt.
- B. BUR-2: Firestone (4 Ply Built-Up Roof w/Gravel Surfacing over metal deck)**
- 1. Field Assembly (from bottom to top)
 - a. Substrate: Flat metal deck.
 - b. Drip Sheet: Rosin Paper
 - c. Substrate Board: 1" Perlite mechanically fastened
 - d. Vapor Retarder: 2 Ply (Ply IV) set in hot moppings of type III asphalt.
 - e. Rigid Insulation: Tapered polyisocyanurate insulation adhered with Type III asphalt;
 - f. Cover board: 1" Fiberboard or Perlite (FiberTop) adhered with Type III asphalt;
 - g. Membrane: 4 Ply (Ply VI) set in hot moppings of type III asphalt.
 - h. Surfacing: Flood coat of Type III asphalt and aggregate surfacing set in Type III asphalt.
 - 2. Basewall flashing assembly:
 - a. Substrate: Plywood;
 - b. Backer ply: Two plies (Ply VI) set in hot moppings of type III asphalt.
 - c. Cap flashing ply: SBS Premium set in hot moppings of type III asphalt.
- C. BUR-3: Firestone (4 Ply Built-Up Roof w/Gravel Surfacing over uninsulated metal deck)**
- 1. Field Assembly (from bottom to top)
 - a. Substrate: Flat metal deck.
 - b. Drip Sheet: Rosin Paper
 - c. Cover board: 1" Fiberboard or Perlite (FiberTop) adhered with Type III asphalt;
 - d. Membrane: 4 Ply (Ply VI) set in hot moppings of type III asphalt.
 - e. Surfacing: Flood coat of Type III asphalt and aggregate surfacing set in Type III asphalt.
 - 2. Basewall flashing assembly:
 - a. Substrate: Plywood;
 - b. Backer ply: Two plies (Ply VI) set in hot moppings of type III asphalt.
 - c. Cap flashing ply: SBS Premium set in hot moppings of type III asphalt.

2.2 BUILT-UP ASPHALT ROOFING - SHEET MATERIALS

- A. Built-up Bituminous Membrane Roofing System:**
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis of Design: Firestone.
 - b. Johns Manville.
 - c. GAF Building Materials Corp.
 - d. Kemper Systems.

-
- B. Asphalt: Insulation adhesive and interplay moppings:
 - 1. ASTM D 312, Type III.
 - C. Roof Vapor Retarder:
 - 1. Base Ply Membrane: Firestone Ply IV
 - 2. Description: Ply felt, asphalt-impregnated, glass-fiber felt, complying with ASTM D 2178, Type IV.
 - D. Roof Membrane:
 - 1. Roof Membrane: Firestone Ply VI (Three-Ply for R-3; Four-Ply for R-1 and R-2).
 - 2. Description: Ply felt, asphalt-impregnated, glass-fiber felt, complying with ASTM D 2178, Type VI.
 - E. Backer & Stripping Plies:
 - 1. Firestone Ply VI (Two backer plies for base flashing and 3 stripping plies for other penetrations)
 - a. Description: Ply felt, asphalt-impregnated, glass-fiber felt, complying with ASTM D 2178, Type VI.
 - F. Base Flashing Ply
 - 1. Base Flashing Ply (exposed sheet): Firestone SBS Premium
 - 2. Description: SBS-modified asphalt sheet, granular surfaced; suitable for application method specified; manufacturer's standard thickness and weight; and reinforced with composite woven or nonwoven polyester and glass-fiber mat. Granule color to be selected by Architect/University.
 - G. Surfacing
 - 1. Flood Coat & Gravel Surfacing (Roof Areas R-1 & R-2): ASTM D 312, Type III flood coat with natural gravel shall be commercial grade, washed, ½ inch to number 4 sieve, or 3/8" to 3/4" inch depending on application, and shall comply with ASTM D1863. No more than 10% of any lot shall be outside these size requirements. Gravel shall be dry and free of dust, soil and foreign matter.
 - 2. Cap Sheet Membrane: Firestone SBS FR Cap (Roof Areas R-3)
 - a. Description: SBS-modified asphalt sheet, granular surfaced; suitable for application method specified; manufacturer's standard thickness and weight; and reinforced with composite woven or nonwoven polyester and glass-fiber mat. Granule color to be selected by Architect/University.

2.3 AUXILIARY ROOFING MEMBRANE MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
- B. Asphalt Primer: ASTM D 41.
- C. Asphalt Roofing Cement: Premium grade, ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.
 - 1. Firestone MB Multi-Purpose Flashing Cement
 - 2. GAF Ruberroid Modified Bitumen Flashing Cement

3. Karnak 19 AF
 4. Johns Manville Bestile Industrial Roof Cement
 5. Tremco ELS
- D. Reinforcing fabric for sealing base flashings shall be ASTM D1668, Type I.
- E. Temporary water Cut-Off Mastic: As recommended by manufacturer. Organic felt, meeting the requirements for ASTM D226 Type I, shall be used exclusively for nightly tie-offs.
- F. Base flashing anchors: Galvanized barbed roofing nails with 40 mm (1-1/2 in.) penetration, through 25 mm (1 in.) galvanized metal discs.
- G. Scupper flanges to wood blocking: 1-3/4-inch galvanized ring or annular shank roofing nails.
- H. Metal Flashing Sheet: As specified in Division 07 Section "Sheet Metal Flashing and Trim."
- I. Pipe or vent jackets shall be a frost-proof type with a lead cap and fabricated of galvanized iron, and designed for use on flat roof construction. Verify at work site for quantity and size. Approved Products: No.1-F flat plumbing vent flange by F. J. Moore Manufacturing Company.
- J. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing membrane.
- K. Lead Flashing for Drains: ASTM D4586 Type I, Class I, 4lbs per square foot.
- L. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.
- B. Rigid Insulation (Fill and Tapered): High thermal insulation is to be Isocyanurate with glass membrane facers and conform to ASTM C 1289 Standard Specification for rigid cellular polyisocyanurate thermal insulation board, Type II, Class I, Grade 2. Dimensional stability of 2%, 24 hr minimum cure time plus an additional 24 hours per inch. All packages shall have RIC/TIMA label.
1. Maximum board size: 4' x 4'
 2. Maximum board thickness: 2", Minimum thickness 1.0"
 3. Approved manufacturers are:
 - a. Atlas
 - b. Firestone
 - c. GAF
 - d. Hunter Panels

- e. Johns Manville
 4. High density rigid insulation where indicated shall meet ASTM C 1289, Type II, Class I, Grade 3 (25 psi).
 5. Tapered boards shall be a 1/4-inch per foot slope minimum unless indicated otherwise on the drawings and thickness. All tapered crickets and saddles shall be twice the slope of the field of the roof.
 6. Average aged R-Value of roof shall be a minimum of R-30.
- C. Cover Board Insulation: Rigid, mineral-aggregate thermal insulation board consisting of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal-coated, complying with ASTM C 728. Or Wood fiberboard meeting ASTM C208 with surface treatment. UL and FM rated and labeled. Insulation is to be supplied in 4' x 4' boards, 1-inch thick.
1. Firestone: HD wood fiberboard - FiberTop
 2. Johns Manville: Fesco Board
 3. GAF Energy Guard.
 4. High density cover board insulation where indicated shall be:
 - a. Firestone: HD wood fiberboard - FiberTop
 - b. Johns Manville: Fesco Board HD
 5. Provided tapered edge strips of similar material.
- D. Substrate Board: Rigid, mineral-aggregate thermal insulation board consisting of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal-coated, complying with ASTM C 728. UL and FM rated and labeled. Insulation is to be supplied in 4' x 4' boards, 1-inch thick.
1. Johns Manville: Fesco Board HD
 2. Manufacturer approved equal.

2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer
- C. Substrate Board-to-Steel Decks
1. Self-tapping #12 or #14 fluorocarbon coated screw with drill point, through minimum 6.5 sq. in. hot-dipped galvanized steel plate. Plates and screws must be clearly labeled from the same manufacturer and shall be intended to be used together.
 2. Install screws with manufacturer's recommended screw guns and bit sizes.
 3. Minimum pull-out strength of 1335 N (300 lb.) per fasteners and acceptable to Factory Mutual for Class 1-90 construction.
 4. Minimum 19 mm (3/4 in.), maximum 30 mm (1-1/4 in.) penetration through flanges. Length to penetrate top of deck but not extend below the bottom of the rib. Change screw length in tapered insulation sections to meet this criterion.

5. Screw-and-plate type fastener to be Factory Mutual approved. Approved Manufacturers:
 - a. Johns Manville
 - b. Firestone
 - c. OMG
 - d. SFS Intec
 - e. Tru-Fast
- D. Insulation-to-Insulation or Insulation-to-Vapor Retarder
 1. Roofing Asphalt: ASTM D 312, Type III.

2.6 CONCEALED FLASHING

- A. Concealed flashing is to be installed below all sheet metal and overlap top of base flashing.
 1. Cured EPDM field sheet, 1mm (45 mil) thick; manufactured by Firestone, or Johns Manville. Only to be used when not in contact with asphalt.
 2. Self-Adhering Concealed Flashing: Grace Ultra by Grace Construction Products.
 3. Adhesives, lap sealant and primers as recommended by flashing manufacturer.
- B. Concrete Walkway Pavers: Natural color concrete pavers; 24" x 24" x 2" thick, installed over cap sheet protection layer cut to fit under pavers and adhered to roof cap sheet.
 1. Space pavers a minimum of 2 inches apart.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 1. Verify that roof openings and penetrations are in place and securely anchored. Verify curbs are set and braced and that roof drain bodies are securely clamped in place.
 2. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 3. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 5. Verify that all roof drains are functioning and clean of any obstructions located within the working area. Protect roof drains from accumulating debris during all construction activities. Roof drains and overflow drains shall be operational at all times.
 6. Verify that flatness and fastening of roof decks comply with installation tolerances. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.5 mm) out of plane.

- C. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.
- D. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. A fume recovery system must be used at all times when utilizing hot asphalt. Temporarily cover and coordinate temporary shut downs of intakes when hot asphalt is being applied. Remove all temporary covers after work has completed at the end of each working day. Stage project in such a manner that the tanker/kettle will not be located up-wind or near intakes. Closely coordinate all hot asphalt work with other trades and adjacent building managers.
- D. Stage project in such a manner that travel on freshly installed felts or membranes will not occur.
- E. Coordinate and protect the newly installed roof system during construction activities. Minimum protection shall include 1-inch of extruded insulation and plywood.
- F. Coordinate with other trades to ensure that all wood, sheathing that will be in contact with asphalt will be non-treated.
- G. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. and allow primer to dry. Seal all openings in deck to minimize the potential of drippage.

3.3 SUBSTRATE BOARD INSTALLATION (ON METAL DECK)

- A. At metal decks, all deck flutes shall be free of any water, ice or debris.
- B. Install red rosin drip sheet over metal decks.
- C. Install perlite board insulation with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt protection boards together.
 - 1. Secure protection board to top flanges of steel deck according to requirements of FM's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Secure protection board to top flanges of steel deck using at least 1 fastener for each 2 sq. ft. (0.19 sq. m). If manufacturer's fastening requirements exceed

those of this section, then manufacturer's recommendations are to be followed.

3. Ensure that fasteners do not penetrate conduit or miscellaneous piping located at bottom of decking.

3.4 ROOF VAPOR BARRIER INSTALLATION

- A. Install 2 felt plies lapping each felt 19 inches over proceeding felt. Embed each felt in a solid mopping of hot roofing asphalt applied at a rate of 25lb/100 sq. ft. plus or minus 10 percent. Glaze-coat completed surface with hot roofing asphalt applied at a rate of 20 lb/100 sq. ft. (1 kg/sq. m), plus or minus 10 percent. Felts are to be broomed into the hot asphalt with a bristle push broom.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations. Install vapor barrier up wall/curb and tie-in with wall vapor retarder if present. Coordinate with other trades.
- C. No phased construction will be allowed. The roof section is to be completed with a full two-ply application. If it should become necessary to employ a phased application due to a sudden rainstorm, the temporarily installed felts must be removed prior to a full two-ply application.

3.5 ROOF INSULATION INSTALLATION

- A. Comply with roofing system manufacturer's written instructions for installing roof insulation.
- B. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- C. Install flat stock and tapered insulation under area of roofing to conform to slopes indicated on the Shop Drawings.
- D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 2. Insulation boards are to be "stepped in" continuously to ensure 100% adhesion.
- E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.0 inches or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- G. Sump all roof drains and scuppers.

- H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together.
- J. Attached Insulation: Set each layer of insulation in a solid mopping of hot roofing asphalt. Insulation is to be installed in a solid mopping of hot Type III (steep) asphalt within 25 degrees of manufacturer's recommended EVT, staggered 50% from proceeding layer and applied at a rate of 25-30 lbs./100 sq. ft. minimum.
- K. Install 4"x4" wood cants prior to installation of membrane at all transitions.

3.6 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install built-up roofing membrane system according to applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-Up Roofing."
 - 1. Install roofing system according to applicable specification plates of NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Cooperate with inspecting and testing agencies engaged or required to perform services for installing built-up roofing membrane system.
- C. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.
 - 1. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Asphalt Heating: Heat roofing asphalt and apply within plus or minus 25 deg F (14 deg C) of equiviscous temperature, unless otherwise required by roofing system manufacturer. Do not raise roofing asphalt temperature above the equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point. Discard roofing asphalt maintained at a temperature exceeding 500 deg F (260 deg C) for more than 4 hours. Keep kettle lid closed, unless adding roofing asphalt.
 - 1. Aggregate Surfacing: Limit temperature of asphalt flood coat to the minimum required for proper embedment of aggregate and the maximum that will permit retention of required coating weight based on slope of surface.
 - 2. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. If mopping is applied directly to substrate, tape substrate joints.
- E. The contractor shall monitor temperature in kettle/tanker, lugger and mop cart to ensure specified application temperatures are followed. Kettle/tanker and lugger shall

utilize built-in functional thermometer while mop carts shall be monitored with hand held thermometer supplied by contractor.

3.7 ROOF MEMBRANE INSTALLTION

- A. Built-Up Roof Plies: Install ply felts, starting at low point of roofing system. Align ply felts without stretching. Shingle side laps of ply felts uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water. Extend ply felts over and terminate beyond cants.
1. Install 4 ply felts at roof areas R-1 and R-2. Install 3 ply felts at roof area R-3. No phased construction is permitted. The roof section is to be completed with a full four ply application at the end of each working day. If it should become necessary to install a temporary membrane, the temporary felts are to be removed prior to a full four ply application.
 2. Application: Over insulation, apply roofing felt set in hot (at EVT) asphalt as specified. Embed each ply felt in a solid mopping of hot roofing asphalt applied at the rate of 25 lbs./100 sq. ft. plus or minus 10%, to form a uniform membrane without ply felts touching each other.
 3. Squeegee or press felts into hot bitumen providing tight, smooth laminations without wrinkles, buckles, kinks, or fishmouths. Air void pockets, as determined by test samples, shall not exceed 5 percent per interply mopping for individual sample and average of all samples shall be less than 3 percent per interply mopping.
 4. Minimize traffic on recently installed membrane. Use sequencing and equipment that will prevent asphalt displacement. Do not walk directly on felts for a minimum of 20 minutes to allow for proper adhesion of the felts.
 5. Install two additional plies of fiberglass felt in full mopping of asphalt at sleeper curbs, pipes supports, and splashpans.
 6. Install three stripping plies over primed embedded penetration flashings such as soil stacks and roof drain leads.
- B. Install modified bituminous cap sheet according to roofing manufacturer's written instructions.
1. Unroll cap sheet starting from the low point of the roof and let membrane relax as recommended by the manufacturer. Care must be taken to insure good alignment of the first roll (parallel with the edge of the roof). A 45 degree cut shall be made on the selvage edge of underlying membrane prior to application to insure a good seal between the membrane.
 2. Maintain EVT of asphalt to temperature as recommended by manufacturer. All cap sheet shall be 100 percent bonded to the three-ply membrane without voids, blisters, dry laps or fish mouths.
 3. On first filed cap membrane install at internal drain low point, embed granules on finished edge to create selvage edge (4 inch lap) at both longitudinal sides. Six (6) inch at end laps.
 4. Field cap membrane ply shall have side laps of three (3) inches and end laps of six (6) inches. Prior to installation of following ply embed surface granules on laps by heating the membrane and pressing the granules into the melted asphalt with a hot trowel. Cover any asphalt seepage with a sprinkling of loose granules; color to match membrane.

3.8 ROOF BASE FLASHING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates as follows:
 - 1. Backer Sheet Application: Install two (2) backer sheets and adhere to substrate in a solid mopping of hot roofing asphalt.
 - 2. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer. All base flashings shall be installed by heat-fusing or solid asphalt (Type III) mopping the material to the substrate and, while pliable, rubbing it in so as to achieve intimate contact.
- B. Extend base flashing up walls or parapets a minimum of 12 inches) above roof membrane and 8 inches onto field of roof membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - 1. Apply a solid troweling of asphalt roof cement along the end joints and, while pliable, embed a four-inch width of fiberglass reinforcing fabric. Embed granules in mastic with still pliable.
- D. Immediately after the installation of the base flashing, install concealed flashing fully adhered to the substrate and overlapping the base flashing so roof is watertight.
- E. At curb details where indicated on Drawings, seal top of wood blocking by fully adhering concealed flashing to cover the top of the base flashing .
- F. Install stripping where metal flanges and edgings are set on built-up roofing.
 - 1. Flashing-Sheet Stripping: Install flashing-sheet stripping in a solid mopping of hot roofing asphalt, and extend onto roof membrane.
 - 2. Built-up Stripping: Install stripping of not less than 3 plies of roof membrane felt, setting each ply in a solid mopping of hot roofing asphalt, extended onto roof membrane 4 inches , 6 inches and 8" respectively.

3.9 AGGREGATE SURFACING

- A. Promptly after installing and testing roof membrane, flashing, and stripping, flood-coat roof surface with 60 lb/100 sq. ft. (3 kg/sq. m) of hot roofing asphalt. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:
 - 1. Aggregate Weight: 400 lb/100 sq. ft. (20 kg/sq. m), average.
 - 2. If aggregate surfacing is delayed, promptly apply glaze coat of hot roofing asphalt at the rate of 10 lb/100 sq. ft. (0.5 kg/sq. m).
 - 3. Double flood and gravel in a 10' by 10' area at exterior corners; below splash pans, pipe supports, and access ladders; and within 3' of roof hatches. Remove loose non-embedded aggregate, pour a uniform additional flood coat, and completely cover with aggregate, as described above.

3.10 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect and University 48 hours in advance of date and time of inspection.
- B. Roofing system will be considered defective if it does not pass tests and inspections.
 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
- C. Owner may engage an independent testing and inspecting agency to perform field inspections and quality-assurance tests.
 1. Testing agency will prepare reports stating whether inspected and tested Work complies with or deviates from requirements.
- D. Correct deficiencies in or remove and replace roof membrane that inspections and test reports indicate does not comply with specified requirements.
 1. Repair roof membrane that does not comply with specified requirements by re-adhering test specimens back in place and by applying additional plies, equal to the original number of plies specified, over test specimens according to roofing system manufacturer's written instructions.
- E. Additional testing, at Contractor's expense, may be performed to determine that corrected Work complies with specified requirements.
- F. Test Cuts: Before flood coating and surfacing built-up roofing membrane, test specimens will be removed to evaluate problems observed during quality-assurance inspections of roof membrane as follows:
 1. Approximate quantities of components within roof membrane will be determined according to ASTM D 3617.
 2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with the criteria established in Appendix 3 of ARMA/NRCA'S "Quality Control Guidelines for the Application of Built-up Roofing."

3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and University.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Clean up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- E. Remove asphalt markings from finished surfaces.

- F. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs, structures, vehicles and utilities.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
1. Flashings and counterflashings.
 2. Formed coping and parapet caps.
 3. Scuppers, gutters and downspouts.
 4. Sheet metal fabricated items.
 5. Provide reglets and accessories, sheet metal splash pans
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 03 1000 - Concrete Forming and Accessories: Placement of recessed flashing reglets and accessories.
 3. Section 04 2000 - Unit Masonry: Through-wall flashings in masonry.
 4. Section 06 1053 - Miscellaneous Rough Carpentry: Wood blocking for metal roofing substrate profiles.
 5. Section 07 7100 - Roof Specialties: Preformed flashings.
 6. Section 07 9000 - Joint Protection.
 7. Section 08 6300 - Metal-Framed Skylights: Metal curbs.
 8. Section 09 9000 - Painting and Coating: Field painting.

1.2 REFERENCES

- A. American Architectural Manufacturers Association:
1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM International:
1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 2. ASTM A625/A625M - Standard Specification for Tin Mill Products, Black Plate, Single Reduced.
 3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

4. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 5. ASTM B32 - Standard Specification for Solder Metal.
 6. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 7. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
 8. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 9. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
 10. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- C. Federal Specification Unit:
1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- D. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Architectural Sheet Metal Manual.

1.3 DESIGN REQUIREMENTS

- A. Sheet Metal Flashings: Conform to the following criteria of SMACNA "Architectural Sheet Metal Manual."
- B. Gutter and Downspout Components: Conform to applicable code for size and method of rain water discharge.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.
- D. Samples:
1. Submit two samples 8 x 8 inch in size illustrating metal finish color of each exposed product.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials : For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.6 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal work with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials causing discoloration or staining.

1.9 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate with Work of Section 04 2000 for installing recessed flashing reglets.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

- A. Pre-Finished Aluminum Sheet: ASTM B209; alloy and temper as required for application and finish; 0.032 inch thick; finish shop pre-coated with three coat fluoropolymer top coat; custom color to match curtainwall.
- B. Stainless Steel: ASTM A240/240M; Type 304, dead soft fully annealed; smooth surface, smooth surface, mill finish.

2.2 ACCESSORIES

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Underlayment: ASTM D226; Type I, No. 15 unperforated asphalt felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc molybdate type.
- E. Protective Backing Paint: Zinc molybdate alkyd.
- F. Sealant: Type E butyl sealant specified in Section 07 9000.
- G. Plastic Cement: ASTM D4586, Type I.
- H. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
 - 1. Material: Stainless steel, 0.022 inch thick.
 - 2. Finish: Mill.

2.3 FABRICATION

- A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet metal, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with concealed batten or flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

- G. Fabricate vertical faces with bottom edge hemmed to form drip.
- H. Fabricate gutters to profile and size specified on Drawings.
- I. Seal metal joints.

2.4 FACTORY FINISHING

- A. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605, two coat system, with minimum 70 percent polyvinylidene fluoride resin.
 - 1. Finish / Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
- B. Washcoat: Finish concealed side of metal sheets with washcoat compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- C. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets to lines and levels indicated on Drawings. Seal top of reglets with sealant.
- C. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mils.

3.3 INSTALLATION

- A. See Section 04 2000 for installation of concealed reglets.
- B. Insert flashings into reglets to form tight fit. Secure in place with [lead] [plastic] wedges. [Pack remaining spaces with lead wool.] Seal flashings into reglets with sealant.
- C. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- D. Apply plastic cement compound between metal flashings and felt flashings.

- E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal metal joints watertight.
- G. Seal metal joints watertight.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 8100

APPLIED FIREPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. Intumescent paint fireproofing for structural steel in limited area.
 - 1. Provide at High Bay structure above mezzanine floor extents.
- C. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 1200 - Structural Steel Framing.
 - 3. Section 05 2100 - Steel Joist Framing.
 - 4. Section 05 3123 - Steel Roof Decking.
 - 5. Section 07 8400 - Firestopping.
 - 6. Section 09 2116 - Gypsum Board Assemblies: Gypsum board fireproofing.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 3. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
 - 4. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
 - 5. ASTM E760 - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
 - 6. ASTM E761 - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
 - 7. ASTM E859 - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
 - 8. ASTM E937 - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
 - 9. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- C. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

- D. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- E. Underwriters Laboratories Inc.:
 - 1. UL - Fire Resistance Directory.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

- A. Applied (Sprayed-On) Fireproofing Systems: Provide fire rated assemblies to hourly ratings as follows:
 - 1. Structural Frame: 2 hours.
 - 2. Floors and Floor Ceilings: 2 hours.
 - 3. Roofs and Roof-Ceilings: 1 hour.
- B. Corrosion: No contribution to corrosion of steel test panels when tested in accordance with ASTM E937.
- C. Mold Resistance: Material to show resistance to fungi growth when tested in accordance with ASTM C665 requirements for fungi resistance of insulation or ASTM G21.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data indicating product characteristics, performance criteria, and limitations of use.
- C. Test Reports: Indicate the following:
 - 1. Compressive Strength: ASTM E761.
 - 2. Dry Density: ASTM E605.
 - 3. Bond Strength of Fireproofing: ASTM E736.
 - 4. Bond Impact: ASTM E760.
 - 5. Fire test reports of fireproofing application to substrate materials, including primers, similar to Project conditions, conducted in conformance to ASTM E84 and ASTM E119.
 - 6. Air Erosion: ASTM E859.
 - 7. Corrosion: ASTM E937.
 - 8. Mold Resistance: ASTM C665 or ASTM G21.
- D. Intumescent Paint Fireproofing Systems Test Reports: Indicate the following:
 - 1. Fire test reports of fireproofing application to substrate materials, including primers, similar to Project conditions, conducted in conformance to ASTM E84 and ASTM E119.
- E. Manufacturer's Installation Instructions: Submit information including special procedures, and conditions requiring special attention.

- F. Manufacturer's Certificate: Certify applied fireproofing products meet or exceed specified requirements.
 - 1. Certify applied fireproofing products contain no asbestos or other finely-divided particulate matter that can be released as airborne health hazard during or after application.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content (LEED Credits MR 4.1 and MR 4.2): For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials (LEED Credits MR 5.1 and 5.2): For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.6 QUALITY ASSURANCE

- A. Fireproofing Assembly: Rating as indicated on Drawings.
 - 1. Tested Rating: Determined in accordance with ASTM E119.
- B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section, with minimum three years [documented] experience.
- B. Applicator: Company specializing in performing Work of this section, with minimum five years experience.

1.8 MOCKUP

- A. Section 01 4000 - Quality Requirements: Requirements for mockup.
- B. Construct mockup on structural member in High Bay area. Conform to Project requirements for fire ratings, thickness, and density of application.
- C. Examine installation within one hour of application to determine variances from specified requirements due to shrinkage, temperature, and humidity.
- D. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary. Remove materials and re-construct mockup.
- E. Locate where directed by Architect/Engineer.
- F. Incorporate accepted mockup as part of Work.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Maintain minimum ambient and substrate temperature of 40 degrees F during and for minimum 24 hours after application of fireproofing, unless otherwise recommended by manufacturer.
- C. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- D. Provide temporary enclosure to prevent spray from contaminating air.

1.10 SEQUENCING

- A. Section 01 1000 - Summary: Work sequence.
- B. Sequence Work in conjunction with placement of mechanical component hangers, and electrical components.
- C. Do not allow application of sprayed-on fireproofing to underside of roof deck until roofing is completely installed and weathertight, penthouses are complete, roof top mechanical units have been placed, and construction roof traffic has ceased.

1.11 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish manufacturer's standard warranty for applied fireproofing.

PART 2 PRODUCTS

2.1 INTUMESCENT PAINT FIREPROOFING

- A. Acceptable Manufacturers:
 - 1. AD Fire Protection Systems, Inc.
 - 2. Albi Manufacturing.
 - 3. Carboline Company .
 - 4. Nu-Chem Inc.
 - 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Intumescent Fireproofing: Water based, factory mixed, asbestos free, intumescent material blended for uniform texture; color as selected.
- C. Primer: Type recommended by manufacturer.

2.2 ACCESSORIES

- A. Primer, Adhesive, Bonding Agent, Coating: Of type recommended by fireproofing manufacturer.
- B. Water: Clean, potable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces are ready to receive fireproofing.
- C. Verify clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- D. Verify ducts, piping, equipment, or other items interfering with application of fireproofing have not been installed.
- E. Verify voids and cracks in substrate have been filled. Verify projections have been removed where fireproofing will be exposed to view as finish material.
- F. Verify roof traffic has ceased and roof mounted equipment is in place.

3.2 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials affecting bond by scraping, brushing, scrubbing, or sandblasting.

- C. Prepare substrates to receive fireproofing.
- D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.
- E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
- F. Close off and seal duct work in areas where fireproofing is being applied.

3.3 APPLICATION - INTUMESCENT PAINT FIREPROOFING

- A. Apply primer and fireproofing in accordance with manufacturer's instruction.
- B. Cut back primer 3 inches for bolted connections and 12 inches for welded connections.
- C. Apply fireproofing in sufficient thickness to achieve indicated fire rating with as many passes necessary. Provide smooth appearance.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, and testing.
- B. Independent Testing Agency To:
 - 1. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
 - 2. Test frequency and type in accordance with applicable code and authorities having jurisdiction.
 - 3. Inspect for the following:
 - a. Installed Thicknesses and Density: ASTM E605.
 - b. Bond Strengths: ASTM E736.
 - 4. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Section 01 4000 - Quality Requirements: Manufacturers' field services.
- B. Observe site conditions, conditions of surfaces and installation, quality of workmanship, and initiate instructions when necessary.
- C. Manufacturer's Field Reports: Document above observations; include environmental conditions under which fireproofing materials were installed.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove excess material, overspray, droppings, and debris.
- C. Remove fireproofing from materials and surfaces not required to be fireproofed.

- D. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes firestopping as follows:
1. Penetrations through fire-resistance-rated floor and roof assemblies requiring protected openings including both empty openings and openings that contain mechanical and electrical penetrating items (ducts, pipes, raceways, conduit, etc.).
 2. Penetrations through fire-resistance-rated wall assemblies including both empty openings and openings that contain mechanical and electrical penetrating items (ducts, pipes, raceways conduit, etc.).
 3. Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.
 4. Joints in fire-resistance-rated assemblies to allow independent movement.
 5. Perimeter Fire Barrier System between a rated floor/roof and an exterior wall assembly.
 6. Joints, through penetrations and membrane penetrations in Smoke Barriers and Smoke Partitions.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 04 0503 - Masonry Mortaring and Grouting: Mortar used for firestopping.
 3. Section 07 2600 - Vapor Retarders: Vapor retarder materials to adjacent insulation.
 4. Section 26 0533: Raceways and Boxes for Electrical Systems
 5. Section 26 0536: Cable Trays for Electrical Systems.

1.2 REFERENCES

- A. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
- B. International Building Code (IBC).
- C. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
 5. ASTM E 2174, "Standard Practice for On-site Inspection of Installed Firestops"

6. ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"
- D. Intertek Testing Services (Warnock Hersey Listed):
 1. WH - Certification Listings.
 2. Fire-Resistant Joint Systems.
- E. National Fire Protection Association:
 1. NFPA 70 - National Electric Code
 2. NFPA 101 - Life Safety Code
 3. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- F. Underwriters Laboratories Inc.:
 1. UL 263 - Fire Tests of Building Construction and Materials.
 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
 5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Systems consisting of a material, or combination of materials installed to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and/or hot gases through penetrations, blank openings, construction joints, or at perimeter fire containment in or adjacent to fire-rated barriers in accordance with the requirements of the Building Code for this project.

1.4 PERFORMANCE REQUIREMENTS

- A. Conform to applicable codes for fire resistance ratings and surface burning characteristics.

1.5 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on product characteristics, performance and limitation criteria. Submit material safety data sheets that will be provided with product delivered to job-site.
- C. Manufacturer's Installation Instructions: Submit preparation and installation instructions.
- D. Manufacturer's Certificate: Certify products meet or exceed applicable code requirements.
- E. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to

authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.6 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

- B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum ten years documented experience and with at least one of the following qualifications:
 - 1. FM 4991 Approved Contractor
 - 2. UL Approved Contractor
- C. A manufacturer's direct representative (not distributor or agent) shall be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. Training will be done per manufacturer's written recommendations published in their literature and drawing details.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.
- D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in

Part I. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems.

- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.2 FIRESTOPPING

- A. Acceptable Manufacturers:
1. Dow Corning Corp.
 2. Hilti Inc.
 3. 3M Fire Protection Products.
 4. Tremco, Inc.
 5. Thermafiber, LLC
 6. United States Gypsum Co.
 7. WR Grace Construction Products
 8. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Product Options: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Devices
 - a. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls.
 - b. Firestop device for use with noncombustible and combustible pipes (closed and open systems), or conduit penetrating concrete floors.
 - c. Firestop device for use with Cable penetrations and low-voltage wiring.
 2. Sealants and Foams
 - a. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).
 - b. Sealants or caulking materials for use with sheet metal ducts.
 - c. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps.
 - d. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles.
 3. Protective Materials
 - a. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes.
 - b. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems).
 - c. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways.
 - d. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways.

- e. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables are expected.

- B. Product Materials
 - 1. Self-Leveling: Silicone elastomeric firestop sealant for floor penetrations.
 - 2. Silicone Elastomeric Firestopping: Single or multiple component silicone elastomeric compound and compatible silicone sealant.
 - 3. Foam Firestopping Compounds: Single or multiple component foam compound.
 - 4. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 - 5. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 6. Firestop Pillows: Formed mineral fiber pillows.
 - 7. Preformed cast-in devices for metal and plastic pipe floor penetrations.
 - 8. Mortar as specified in Section 04 0503 where permitted by applicable code.

- C. Color: As selected from manufacturer's full range of colors.

2.4 ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

- B. Dam Material: Permanent:
 - 1. Mineral fiberboard.
 - 2. Sheet metal.

- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

- B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

- B. Remove incompatible materials affecting bond.

- C. Install backing materials to arrest liquid material leakage.

3.3 FIRESTOP IDENTIFICATION AND VERIFICATION

- A. Identify through-penetration firestop systems as required below, with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone specifically seeking to remove penetrating items or firestop systems. Do not place labels where they are visible to the general public. Include the following information on labels:
1. The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's Name, address, and phone number.
 3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of Installation.
 5. Through-Penetration firestop system manufacturer's name.
 6. Installer's Name.
- B. Scope: The following penetrations through a fire-rated wall shall be labeled:
1. Penetrations requiring mineral wool or a unique UL designation.
 2. Large duct or pipe penetrations, greater than 3' x 3'
 3. Locations of multiple penetrations using the same UL Detail in a grouping. Only one sticker will be applied to the group.
 4. The General Contractor and its subcontractors will provide labels at specific penetrations / locations where required by the University.
- C. The following penetrations are NOT required to be labeled:
1. Penetrations requiring a simple bead of fire caulk.
 2. Fire spray at the top of rated walls.
- D. Fire and sound rated walls will be identified above the ceiling, but concealed from general viewing, using stencils and spray paint.
1. Identification shall occur at intervals of approximately 25 feet unless visibility is obstructed, in which case they will be as required for viewing.
- E. General Contractor shall internally track the penetration designations used on the project to assist all trades and facilitate building inspections.

3.4 APPLICATION

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.

- E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- F. [Remove dam material after firestopping material has cured. Dam material to remain.

3.5 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Protect adjacent surfaces from damage by material installation.

3.8 SCHEDULES

- A. Refer to Life Safety Drawings for locations of fire rated walls requiring firestopping.

END OF SECTION

SECTION 07 9000

JOINT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes sealants and joint backing and accessories.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 04 2000 – Unit Masonry: Sealants at masonry wall construction.
 - 3. Section 04 4200 – Exterior Stone Cladding: Sealants at stone wall construction.
 - 4. Section 07 2600 - Vapor Retarders: Sealants required in conjunction with vapor retarders.
 - 5. Section 07 8400 - Firestopping: Firestopping sealants.
 - 6. Section 08 4426 - Structural Glass Curtain Walls: Structural and weatherseal sealants and accessories.
 - 7. Section 08 6300 - Metal-Framed Skylights: Structural and weatherseal sealants and accessories.
 - 8. Section 08 8000 - Glazing: Glazing sealants and accessories.
 - 9. Section 09 3000 – Tile: Sealant used as tile grout.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM C834 - Standard Specification for Latex Sealants.
 - 2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
 - 3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
 - 5. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
 - 6. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - 7. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
 - 8. ASTM C1253 - Standard Test Method for Determining the Outgassing Potential of Sealant Backing.
 - 9. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
 - 10. ASTM D5249 - Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

1.3 SUBMITTALS

- A. Submit product data and samples under provisions of Section 01 3300.

- B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Selection Samples: Submit three copies of manufacturers available sealant colors.
- D. Verification Samples: Submit three actual sealant samples, illustrating sealant colors for approval.
- E. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.
- F. Warranty: Include coverage for installed sealants and accessories failing to achieve airtight seal, exhibit loss of adhesion or cohesion, and sealants that do not cure.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Local / Regional Materials : For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- B. Credit EQ 4.1: Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum five years' experience , and approved by manufacturer.

1.6 MOCKUP

- A. Section 01 4000 - Quality Requirements: Requirements for mockup.
- B. Construct mockup of sealant joints in conjunction with masonry mockups specified in other sections.
- C. Construct mockup with specified sealant types and with other components noted.

1. Determine preparation and priming requirements based on manufacturers recommendations; take action necessary for correction of failure of sealant tests on mock-up.
 2. Verify sealants, primers, and other components do not stain adjacent materials.
- D. Locate where directed by Architect/Engineer.
- E. Remove mockup when directed by Architect/Engineer.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Products Requirements.
- B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.8 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with sections referencing this section.

PART 2 - PRODUCTS

2.1 JOINT SEALERS

- A. Acceptable Manufacturers:
 1. Dow Corning Corporation.
 2. GE Sealants and Adhesives.
 3. Fomo Products, Inc.
 4. Hilti USA
 5. Mameco International Inc.
 6. Pecora Corporation.
 7. Sandell Manufacturing Co., Inc.
 8. Sika Chemical Corp.
 9. Sonneborn Building Products Div. of Chemrex, Inc.
 10. Tremco, Inc.
 11. Substitutions: Under provisions of Section 01 6000 - Products Requirements

2.2 HIGH PERFORMANCE GENERAL PURPOSE EXTERIOR (NONTRAFFIC) SEALANT

- A. High Performance General Purpose Exterior (Non-traffic) Sealant, Polyurethane: ASTM C920, Grade NS, Class 25, Uses NT, M, G, A and O; multi-component.
 1. Acceptable Products:
 - a. Sonneborn Sonolastic NP 2.
 - b. Tremco Dymeric 511.
 - c. Pecora Dynatrol II.
 - d. Equivalent product manufactured by other acceptable manufacturer.
 2. Color: Colors selected from full range of manufacturer's available colors

3. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry (above grade).
 - b. Joints between precast concrete, cast-in-place concrete and other materials.
 - c. Joints between frames and other materials.
 - d. Joints in Exterior Insulation and Finish Systems (EIFS).
 - e. Other exterior nontraffic joints for which no other sealant is indicated.
- B. High Performance Exterior (Non-traffic) Sealant, Polysulfide: ASTM C920, Grade NS, Class 25, Uses M, G, and A; multi-component.
 1. Acceptable Products:
 - a. Sonneborn Sonolastic Polysulfide Sealant.
 - b. Pecora Synthacalk GC2+.
 - c. Equivalent product manufactured by other acceptable manufacturer.
 2. Color: Standard colors matching finished surfaces.
 3. Applications: Use for:
 - a. Control, expansion, and soft joints in below grade concrete and masonry.
 - b. Continuous water-immersion conditions and high chemical exposure.

2.3 EXTERIOR EXPANSION JOINT SEALANT

- A. Exterior (Non-traffic) Sealant, polyurethane, high performance, low modulus, moisture curing: ASTM C920, Grade NS, Class 25, Uses NT, M, A, and O; single component.
 1. Acceptable Products:
 - a. Tremco Dymonic.
 - b. Sonneborn NP 1.
 - c. Pecora Dynatrol I XL.
 - d. Equivalent product manufactured by other acceptable manufacturer.
 2. Color: Standard colors matching finished surfaces.
 3. Applications: Use for dynamically moving joints such as:
 - a. Joints in precast concrete panels.
 - b. Expansion and control joints in masonry and concrete.
 - c. Joints in metal curtainwall.
 - d. Perimeter joints of metal door and window frames. general purpose traffic bearing sealant

2.4 GENERAL PURPOSE TRAFFIC BEARING SEALANT

- A. General Purpose Traffic Bearing Sealant, Polyurethane: ASTM C920, Grade P, Class 25, Use T; multi-component.
 1. Acceptable Products:
 - a. Sonneborn Sonolastic SL 2.
 - b. Tremco THC 900/901.
 - c. Pecora Urexpan NR200
 - d. Equivalent product manufactured by other acceptable manufacturer.
 2. Color: Standard colors matching finished surfaces.
 3. Applications: Use for:
 - a. Exterior concrete, brick and stone paving.
 - b. Vehicular traffic bearing joints in concrete.
 - c. Grey color.

2.5 EXTERIOR METAL LAP JOINT SEALANT

- A. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
1. Acceptable Products:
 - a. Tremco JS-733 Sealant.
 - b. Equivalent product manufactured by other acceptable manufacturer.
 2. Applications: Use for concealed sealant bead in sheet metal work.

2.6 GENERAL PURPOSE INTERIOR SEALANT

- A. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
1. Acceptable Products:
 - a. Tremco Tremflex 834.
 - b. Sonneborn Sonolac.
 - c. Pecora AC-20.
 - d. Equivalent product manufactured by other acceptable manufacturer.
 2. Color: Standard colors matching finished surfaces.
 3. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.

2.7 INTERIOR SANITARY SEALANT

- A. Bathtub/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant.
1. Acceptable Products:
 - a. Sonneborn Omni Plus.
 - b. General Electric Sanitary SCS 1700 Sealant.
 - c. Dow Corning 786 Silicone Sealant.
 - d. Pecora 898 Sealant.
 - e. Tremco Tremsil 200.
 - f. Equivalent product manufactured by other acceptable manufacturer.
 2. Color: Clear.
 3. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between toilet room counter tops and wall surfaces.

2.8 INTERIOR ACOUSTICAL SEALANT

- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Acceptable Products:
 - a. Pecora Corporation; BA-98
 - b. Tremco: Tremco Acoustical Sealant.
 - c. Equivalent product manufactured by other acceptable manufacturer.

2. Applications: Use for concealed locations only at acoustically rated construction.
 - a. In partitions: Provide sealant bead between top stud runner and structure and between bottom stud track and floor.
 - b. Thresholds: Provide sealant bead under each floor contact surface.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834 and reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Acceptable Products:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 - c. Equivalent product manufactured by other acceptable manufacturer.
 2. Applications: Use for exposed or concealed locations only at acoustically rated construction.
 - a. In partitions: Provide sealant bead between top stud runner and structure and between bottom stud track and floor.
 - b. Thresholds: Provide sealant bead under each floor contact surface.

2.9 PRE-COMPRESSED JOINT SEALANT

- A. High density, open cell polyurethane foam impregnated with a flame retardant modified acrylic meeting ASTM C518, ASTM E331 and ASTM E84.
- B. Acceptable Products:
 1. Schul International Company: "Sealtite B".
 2. Substitutions: Under provisions of 01 6000.
- C. Application:
 1. For use under flooring at Clean Room floor structural joints between concrete floor slab and foundation wall along gridline C. Refer to Drawings for joint width and details.

2.10 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber or D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
 1. Type: As manufactured by Dow Chemical Company, Applied Extrusions Technologies, Inc. or equivalent.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and joint openings are ready to receive work.
- C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.
- D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Perform acoustical sealant application work in accordance with ASTM C919.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install precompressed joint sealant in accordance with manufacturer's instructions.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- H. Tool joints concave.

3.4 CLEANING

- A. Section 01 7000 - Execution Requirements: Final cleaning.
- B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 017000 - Execution Requirements: Protecting installed construction.

B. Protect sealants until cured.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes steel doors, panels and frames; non-rated and fire rated.
- B. Related Sections
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 04 2000 - Unit Masonry Assemblies: Masonry grout fill of metal frames.
 - 3. Section 08 1400 - Wood Doors.
 - 4. Section 08 7100 - Hardware: Door hardware and weather-stripping.
 - 5. Section 08 8000 - Glazing: Glass for doors and sidelights.
 - 6. Section 09 2116 - Gypsum Board Systems.
 - 7. Section 09 9000 - Painting: Field finishing of frames.

1.2 REFERENCES

- A. Americans with Disabilities Act (ADA) accessibility guidelines.
- B. American National Standards Institute (ANSI)
 - 1. ANSI A115 - Specifications for Steel Door and Frame Preparation for Hardware.
 - 2. ANSI 250.8 – SDI 100 - Recommended Specifications for Standard Steel Doors and Frames.
- C. ASTM International:
 - 1. ASTM A525 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - 2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 4. ASTM E413 - Classification for Rating Sound Insulation.
 - 5. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies
- D. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- E. National Fire Protection Association (NFPA)
 - 1. NFPA 80 - Fire Doors and Windows.
 - 2. NFPA 252 - Fire Tests for Door Assemblies.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit door and frame configurations, location of cut-outs for hardware reinforcement.
- C. Shop Drawings: Indicate door and frame elevations, internal reinforcement, cut-outs for glazing, and finishes.
- D. Installation Instructions: Submit manufacturer's installation instructions.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI 250.8 and DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- B. Fire Rated Door and Panel Construction: Conform to NFPA 252. Where required by code, provide rated openings with labeled units listed by UL or Warnock Hersey.
- C. Fire Rated Stair Doors: Rate of rise of 450 degrees F across door thickness.
- D. Installed Fire Rated Door and Panel Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- E. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.

1. Indicate temperature rise rating for stair doors.
- F. Surface Burning Characteristics:
1. Foam Insulation: Maximum 75/450-flame spread/smoke developed index when tested in accordance with ASTM E84.
- G. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation material.

1.6 DELIVERY, STORAGE AND PROTECTION

- A. Protect products under provisions of Section 01 6000.
- B. Protect doors with resilient packaging sealed with heat shrunk plastic, or accept doors on site in manufacturer's packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 STEEL DOORS AND FRAMES

- A. Acceptable Manufacturers:
1. Amweld Building Products, Inc.
 2. Ceco Door Products.
 3. Curries Company
 4. Kewanee Corp.
 5. Pioneer Industries.
 6. Republic Builders Products.
 7. Steelcraft.
 8. Substitutions: Under provisions of Section 01 6000.
- B. Product Description: Standard shop fabricated steel doors, and frames; fire rated and non-rated types; flush face.

2.2 COMPONENTS

- A. Exterior Doors (Insulated): ANSI A250.8, 1-3/4 inch thick.
1. Level 3 - Extra heavy Duty, with minimum 16 gauge galvanized steel sheet faces; Model 2, seamless edge design.
- B. Standard Interior Doors (Fire Rated and Non-Rated): ANSI A250.8, 1-3/4 inch thick.
1. Level 2 - Heavy Duty, with minimum 18 gauge cold-rolled steel sheet faces; Model 1, full flush edge design.
- C. Interior Doors in heavy abuse locations (Non-Rated): ANSI A250.8, 1-3/4 inch thick.
1. Level 3 - Extra heavy Duty, with minimum 16 gauge galvanized steel sheet faces; Model 1, full flush edge design.
 2. Provide at Doors B-165 (Waste Recycle), B-168 (Student Shop), 1-166 and 1-70 (Loading Dock).
- D. Exterior Frames:

1. Nominal 14 gage/0.067 inch thick galvanized sheet steel with mitered or coped, continuously welded corners.
- E. Interior Frames:
 1. Nominal 16 gage/0.053 inch thick sheet steel with mitered or coped, continuously welded corners. For use with Level 2 or 3 doors.
- F. Door Core: Internal core shall be manufacturer's standard resin-impregnated paper honeycomb, rigid polystyrene (ASTM C578), unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core.
- G. At exterior doors, provide flush, galvanized steel end closures (18 gauge minimum) at top and bottom edges of doors as an integral part of the door construction. Seal joints in top edges of doors against water penetration.
- H. Thermal Insulated Door: Total insulation R-Value of 7, measured in accordance with ASTM C1363.
- I. Acoustic Door: Manufacturer's standard acoustic core and internal construction is as tested in accordance with to furnish a minimum STC rating of 39, measured in accordance with ASTM E413.

2.3 ACCESSORIES

- A. Door Silencers: Glynn-Johnson GJ 64, or equivalent, molded, non-staining resilient rubber; fitted into drilled holes in frame.
- B. Glazing Stops: Rolled steel, channel shape, mitered corners; prepared for countersunk style tamper proof screws.
- C. Astragals for Double Doors: Steel, Z shaped, specifically for double doors.
- D. Bituminous Coating: Fibered asphalt emulsion.
- E. Primer: ANSI A250.10 rust inhibitive type.
- F. Galvanized Steel Sheet: Galvanized to ASTM A653/A653M A60.
- G. Weather-stripping: Specified in Section 08 7100.
- H. Supports and Anchors: Fabricate from not less than 0.0478 inch (1.2 mm) thick steel sheet; 0.0516 inch (1.3 mm) thick galvanized steel where used with galvanized frames.
- I. Inserts, Bolts, and Exposed Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A153, Class C or D, as applicable. Unless otherwise indicated, provide countersunk flat heads for exposed screws and bolts.

2.4 FABRICATION

- A. Prepare doors to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Fabricate doors and frames with hardware reinforcement welded in place. Protect frame hardware preparations with mortar guard boxes. Comply with applicable requirements of ANSI A115 specifications for door and frame preparation for hardware.
- B. Attach astragal to inactive leaf of pairs of doors.
- C. Configure exterior frames and doors with profile to receive recessed weather-stripping.
- D. Fabricate frames as face welded units.
- E. Fabricate frames to suit masonry wall coursing with 4 inches head member, unless noted otherwise on Drawings.
- F. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- G. Prepare interior frames for silencers and install.
- H. Frame Transom Bars: Fixed type, with profile matching jamb and head.
- I. Attach fire rating label to each fire rated door and frame. Indicate temperature rise rating for stair doors.
- J. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other door panels. Provide screw-applied, removable glazing beads or stops on opposite side of door opening.

2.5 SHOP FINISHING

- A. Surface Preparation: Doors and Frames are to be thoroughly cleaned and chemically treated to remove dirt, oil, grease, and other contaminants that could impair paint adhesion.
- B. Primer: All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air dried or baked on, which complies with ANSI A224.1 acceptance criteria, and is compatible with field finish paint systems specified in Section 09 9000.
- C. Coat inside of exterior frame profiles with bituminous coating.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

- A. Install doors and frames in accordance with ANSI A250.8.
- B. Coordinate installation of doors and frames with installation of hardware specified in Section 08 7100.
- C. Coordinate door frames with wall construction for frame anchor placement. Refer to Drawings for partition types.
 - 1. Anchors for frames in steel stud partition systems shall be screwed, bolted or welded to both flanges of studs. Floor clips shall be attached to the floor with two bolts or power driven anchors per clip. Conceal exposed fasteners in frames.
 - 2. Frames in concrete and masonry construction shall be filled solid with grout.
- D. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- E. Install door louvers plumb and level.
- F. Coordinate installation of glass and glazing specified in Section 08 8000.
- G. Touch-up paint factory finished doors.
- H. Adjust door for smooth and balanced door movement.

3.3 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

END OF SECTION

SECTION 08 1400

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Wood doors and transom panels; flush and flush glazed configuration, non-rated.
 - 2. Factory Finishing.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 08 1113 – Hollow Metal Doors and Frames.
 - 3. Section 08 7100 - Door Hardware.
 - 4. Section 08 8000 - Glazing.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A135.4 - Basic Hardboard.

- B. ASTM International:
 - 1. ASTM E413 - Standard Classification for Rating Sound Insulation.

- C. Architectural Woodwork Institute:
 - 1. AWI - Quality Standards Illustrated.

- D. Hardwood Plywood and Veneer Association:
 - 1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

- E. National Electrical Manufacturers Association:
 - 1. NEMA LD 3 - High Pressure Decorative Laminates.

- F. National Fire Protection Association:
 - 1. NFPA 80 - Standard for Fire Doors, Fire Windows.
 - 2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

- G. Underwriters Laboratories Inc.:
 - 1. UL - Building Materials Directory.
 - 2. UL 10B - Fire Tests of Door Assemblies.
 - 3. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
 - 4. UL 1784 - Air Leakage Tests of Door Assemblies.

- H. Uniform Building Code:
 - 1. UBC Standard 7-2 - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, and factory finishing criteria.
- C. Product Data: Submit information on door core materials and construction, and on veneer species, type and characteristics.
- D. Samples:
 - 1. Submit three samples of door veneer, min 8 x 8 inch in size illustrating wood grain, finish, and sheen.
- E. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealant : Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
- D. VOC Content of Paints and Coatings: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each

product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWI Quality Standard Section 1300, Custom Grade.
- B. Fire Rated Door and Panel Construction: Conform to NFPA 252.
 - 1. 20-Minute Fire Rated Corridor and Smoke Barrier Doors: Fire tested without hose stream test.
- C. Installed Fire Rated Door and Panel Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- D. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.

1.6 QUALIFICATIONS

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.
- D. Protect doors with resilient packaging [sealed with heat shrunk plastic]. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges when stored more than one week.
 - 1. Break seal on site to permit ventilation.

1.8 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with door opening construction, door frame and door hardware installation.

1.9 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.

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- B. Include life of original installation coverage for interior doors covering delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 FLUSH WOOD DOORS

- A. Acceptable Manufacturers:
1. Algoma Hardwoods Inc.
 2. Eggers Industries.
 3. Marshfield Door systems.
 4. VT Industries.
 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Product Description: Solid core flush wood doors; wood veneer facing material; fire rated and non-rated types; flush design; shop finished; wood doors.
1. Flush Interior Doors: 1-3/4 inches thick; solid core, five-ply construction, and fire rated where indicated on Drawings.
 2. Transom Panels: To match door construction, finish and performance. Provide where indicated on Drawings.

2.2 COMPONENTS

- A. Solid Core, Non-Rated: AWI Section 1300, Type PC - Particleboard.
- B. Solid Core, Fire Rated: AWI Section 1300. Refer to Drawings for fire ratings.
- C. Solid Core, Acoustic Door: AWI Section 1300, Type SR - Sound Retardant
1. STC Rating: Minimum 39, measured in accordance with ASTM E413.
 2. Manufacturer's standard acoustic core and internal construction.
- D. Interior Veneer Facing: AWI Custom quality wood, quarter sawn, with center slip matched veneer, for clear transparent finish. Pair match multiple door leaves in single opening.
1. Wood Species: White Oak.
- E. Facing Adhesive: Type I – waterproof.

2.3 FABRICATION

- A. Fabricate doors in accordance with AWI Quality Standards requirements.
- B. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.
- C. Vertical Exposed Edge of Stiles: Hardwood for transparent finish, of same species as veneer facing.
- D. Fit door edge trim to edge of stiles after applying veneer facing.

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- E. Bond edge banding to cores.
 - F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.
 - G. Factory fit doors for frame opening dimensions identified on shop drawings.
 - H. Cut and configure exterior door edge to receive recessed weather stripping devices.
 - I. Provide edge clearances in accordance with AWI 1300.

2.4 SHOP FINISHING

- A. Factory finish doors in accordance with approved sample.
- B. Factory finish to be ultraviolet (UV) cured polyurethane sealer to comply with EPA Title 5 guidelines for Volatile Organic Compound (VOC) emissions limitations. Finish must meet or exceed performance standards of UV cured polyurethane (TR-6).
- C. Seal door top edge with sealer to match door facing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with AWI Quality Standards requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Machine cut or drill doors for hardware installation.
- D. Coordinate installation of doors with installation of frames specified in Section 08 1113 and hardware specified in Section 08 7100.
- E. Coordinate installation of glass and glazing specified in Section 08 8000.

3.3 INSTALLATION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.

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- B. Conform to AWI requirements for fit and clearance tolerances.
 - C. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taut string, corner to corner, over imaginary 36 x 84 inches surface area.
 - D. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over imaginary 36 x 84 inches surface area.
 - E. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over imaginary 36 x 84 inches surface area.

3.4 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust door for smooth and balanced door movement.
- C. Adjust closer for full closure.

END OF SECTION

SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire resistive rated and non-rated access doors and panels with frames.
 - 1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.
 - 2. Coordinate exact locations with various trades to assure proper placement of access doors and panels.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 1000 - Concrete Forming and Accessories: Placement of access frame unit anchors in concrete.
 - 3. Section 08 8700 – Hardware: Cylinder cores for access panels.
 - 4. Section 09 9000 - Painting and Coating: Field paint finish.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.
- C. National Fire Protection Association:
 - 1. NFPA 80 - Standard for Fire Doors, Fire Windows.
- D. Underwriters Laboratories Inc.:
 - 1. UL - Building Materials Directory.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate exact position of access door units.
- C. Product Data: Submit literature indicating sizes, types, finish, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.
- D. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of access units.

1.6 QUALITY ASSURANCE

- A. Fire Resistance Ratings: Where indicated as fire rated provide assemblies from manufacturers listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.
- B. Fire Rated Horizontal Access Doors: Rating as indicated on Drawings.
 - 1. Tested Rating: Determined in accordance with ASTM E119.
- C. Attach label from agency approved by authority having jurisdiction to identify each fire rated access door.

1.7 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

- A. Acceptable Manufacturers:
 - 1. J. L. Industries.
 - 2. Karp Associates.
 - 3. Nystrom Products Co.
 - 4. Milcor LTD, Partnership.
 - 5. Larsen's Manufacturing Co.
 - 6. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

- B. Products**
1. Concealed Flange Gypsum Board Access Doors (Type 1):
 - a. Frames and nominal 1 inch wide flanges of 16 gauge steel and door panels of 14 gauge steel.
 - b. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 2116.
 - c. Provide latching doors with keyed lock; cylinders provided by Section 08 7100.
 - d. For use at non-rated gypsum walls and ceilings.
 2. Concealed Flange Gypsum Board Fire Rated Access Doors (Type 2):
 - a. 16 gage steel frames with minimum 20 gauge galvanized steel drywall bead flanges and door panels of 20 gauge steel.
 - b. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 2116.
 - c. Provide self-closing and latching doors with keyed lock; cylinders provided by Section 08 7100.
 - d. For use at fire rated gypsum walls and ceilings.
 3. Flush Framed Access Doors (Type 3):
 - a. Frames and nominal 1 inch wide exposed flanges of 16 gauge steel and door panels of 14 gauge steel.
 - b. Provide latching doors with keyed lock; cylinders provided by Section 08 7100.
 - c. For use at exposed masonry or concrete walls.
 4. Fire Rated Access Doors (Type 4):
 - a. Frames and nominal 1 inch wide exposed flanges of minimum 16 gauge steel and door panels of 20 gauge steel.
 - b. Provide self closing and latching doors with keyed lock; cylinders provided by Section 08 7100.
 - c. For use at exposed fire rated masonry or concrete walls.

2.2 FABRICATION

- A.** Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.
- B.** Wall and Ceiling Access Door and Panel Hardware:
 1. Hinge: Standard continuous or concealed spring pin type, 175-degree steel hinges.
- C.** Locks: Self-latching lock, key operated. Provide one lock per door panel. Doors shall be able to be released from the interior without a key or a special tool.
 1. Provide cylinders manufactured by Best. The University Key Shop shall specify how the locks are master-keyed. .
- D.** Size Variations: Obtain acceptance of manufacturer's standard size units which vary slightly from sizes shown or scheduled.

2.3 SHOP FINISHING

- A.** Baked on primer with rust-inhibitor. Galvanized doors shall have a Class C coating with phosphate treatment.

- B. Stainless Steel: No. 4 finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify rough openings for access doors and panels are correctly sized and located.

3.2 INSTALLATION

- A. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.
 - 1. Set concealed frame type units flush with adjacent finished surfaces.
- B. Position unit to provide convenient access to concealed work requiring access.
- C. Install fire rated units in accordance with NFPA 80 and requirements for fire listing.

3.3 SCHEDULES

- A. Refer to Drawings for size and locations of access panels.

END OF SECTION

SECTION 08 3323

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Insulated overhead coiling doors.
 - 2. Operating hardware.
 - 3. Electric operation.
 - 4. Provide wiring from electric circuit disconnect to door operator to control station.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 5000 - Metal Fabrications: Support framing.
 - 3. Section 08 7100 - Door Hardware: Product Requirements for cylinder core and keys for placement by this section.
 - 4. Section 09 9000 - Painting and Coating: Field paint finish.
 - 5. Division 26 - Equipment Wiring Connections: Power to disconnect.
 - 6. Division 26 - Raceway and Boxes for Electrical Systems: Conduit from electric circuit to door operator and from door operator to control station.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- B. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

- C. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 3. NEMA MG 1 - Motors and Generators.

- D. National Fire Protection Association:
 - 1. NFPA 80 - Standard for Fire Doors, Fire Windows.

2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
 3. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- E. Underwriters Laboratories Inc.:
1. UL - Building Materials Directory.
 2. UL 10B - Fire Tests of Door Assemblies.
 3. UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.
 4. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 DESIGN REQUIREMENTS

- A. Wind Loads: Design door assembly to withstand wind/suction load of 30 psf, with maximum deflection of 1/120, and without damage to door or assembly components.
- B. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles and 10 cycles per day.
- C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit general construction, component connections and details, wiring diagram and electrical equipment.
- C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Installer: Company specializing in performing work of this section minimum ten years documented experience and approved by manufacturer.

1.8 PROJECT CONDITIONS

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

PART 2 PRODUCTS

2.1 OVERHEAD COILING DOORS

- A. Acceptable Manufacturers:
 1. Cookson Co.
 2. Cornell Iron Works, Inc.
 3. Mahon Door Corporation.
 4. McKeon Rolling Steel Door Company.
 5. Overhead Door Corporation.
 6. Wayne Dalton Corporation.
 7. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Product Description:
 1. Basis of Design: Coiling Insulated Service Door by Overhead Door Corporation, Series 625.
 2. Electric Operation: Electric motor operated unit with manual override in case of power failure.

2.2 COMPONENTS

- A. Curtain: Conform to following;
1. Steel Slats: Interlocking, ASTM A653/A653M steel, minimum galvanized coating designation G90 in accordance with ASTM A924/A924M;
 - a. Front Slat fabricated of 20 gauge galvanized steel.
 - b. Back Slat fabricated of 24 Gauge galvanized steel.
 - c. Insulated sandwich slat construction with manufacturer's standard foamed in place CFC-free polyurethane insulated core. Minimum R value of 7.7, U-Value: 0.13, Sound Rating: STC-21.
- B. Weatherseal: Manufacturer's standard weatherseal at exterior and interior curtain-side guides at each jamb and along interior hood baffle.
1. Vinyl Bottom seal at exterior guide and internal hood seals.
 2. Interior guide weatherseal.
 3. Lintel weatherseal.
- C. Bottom Bar:
1. Two galvanized steel angles minimum thickness 1/8 inch bolted back to back to reinforce curtain in the guides.
- D. Guides: Minimum 3/16 inch; galvanized steel conforming to ASTM A653/A653M, minimum galvanized coating designation G90 in accordance with ASTM A924/A924M
1. Furnish continuous angles of profile to retain door in; mounting brackets of same metal.
 2. Guides weatherstripped with a vinyl weather seal at each jamb on the exterior curtain side.
- E. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, supporting the curtain with deflection limited to 0.03 inch per foot of span; capable of producing torque sufficient to ensure smooth operation of curtain from any position and of holding position at mid-travel; with adjustable spring tension.
- F. Hood Enclosure: Square shape, minimum 24 gage galvanized steel ; internally reinforced to maintain rigidity and shape.
- G. Hardware:
1. Locks: Furnish locks to allow doors to be secured.
 - a. Manufacturer's standard cylinder locking system to secure door; interlock with motor to prevent motor from operating when lock is activated.
 2. Cylinders: Furnished under Section 08 7100, installed as part of Work of this section; doors keyed master keyed.
 3. Handle: Inside center mounted, adjustable keeper, spring activated latch bar with feature to keep in locked or retracted position; interior and exterior handle.
- H. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.

1. Sensing Edge Protection: Manufacturer's standard bottom sensing safety edge and weatherseal located at door bottom, full width, sensitized type, wired to reverse upon striking object. Pneumatic or electric sensing edge.
2. Operator Controls:
 - a. Push-button and key operated control stations with open, close, and stop buttons.
 - b. Controls for interior location.
 - c. Controls surface mounted.
3. Special Operation:
 - a. Door timer operation tied into building security system
4. Motor Design:
 - a. Description: UL 325, side mounted, open drip-proof motor.
 - b. Motor Enclosure: NEMA MG1 Type 1 enclosure.
 - c. Motor Rating: 1/2 hp; continuous duty.
 - d. Motor Voltage: 115 volts single phase, 60 Hz.
 - e. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
5. Controller Enclosure: NEMA 250 Type 1.
6. Brake: Adjustable friction clutch type, activated by motor controller.

2.3 SHOP FINISHING

- A. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on powder coating finish top coat.
 1. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
 2. Powder coating finish in color as selected by Architect from manufacturer's standard colors. Color to closely match PT-5 (Dark Charcoal Gray) – Refer to Section 09 0502.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. Verify opening sizes, tolerances and conditions are acceptable.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Division 26. Complete wiring from disconnect to unit components to door operator.
- F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9000.
- G. Install perimeter trim and closures.

3.4 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maintain dimensional tolerances and alignment with adjacent Work.
- C. Maximum Variation From Plumb: 1/16 inch.
- D. Maximum Variation From Level: 1/16 inch.
- E. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.5 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- C. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- C. Remove labels and visible markings.

- D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 3500

VERTICAL BI-FOLD HANGAR DOOR

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bi-fold hanger door at High Bay.
 - 2. All labor, materials, accessories, equipment and services necessary to furnish a complete installation of a bi-fold hangar door including frame, sections, brackets, guides, tracks, hardware, operators and installation instructions.
- B. Related Sections:
 - 1. Section 07 4243 - Composite Wall Panels: Exterior metal panel door finish (MWP-3).
 - 2. Section 08 4413 – Glazed Aluminum Curtain Wall: Glazed panels in door.
 - 3. Section 08 4113 – Aluminum-Framed Entrances: Entry doors.
 - 4. Section 09 9000 – Painting: Field painting of interior frame.

1.2 DESIGN REQUIREMENTS

- A. The bi-fold hangar doors shall be designed to the same loading requirements for live, dead and wind loads as the building structure.
- B. The doors shall be engineered to resist all anticipated loads without sagging, bowing or conflicting with its smooth and efficient operation.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's data sheets and installation instructions. Include information on materials, dimensions of individual components, profiles, and finishes. Include the following:
 - 1. Summary of forces and loads on walls and jambs.
 - 2. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 - 3. Shop Drawings: Provide detailed plans, elevations, and details of framing members, adjacent materials, required clearance, anchors, operators and controls and accessories.
- C. Manufacturer's Installation Instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Submit the following:

1. Bi-Fold Door Literature.
2. Installation Manual.
3. Operating Instructions.
4. Maintenance data/manual.
5. Safety Decal Placement Guide Manual / Warning Labels
6. Electrical System Manual for the bi-fold door system
 - a. Electrical Schematics
 - b. Electrical Wiring Diagram
7. Diagrams of potentially hazardous locations related to the operation of the door.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain Bi-Fold doors from a single manufacturer.
- B. Manufacturer Qualifications: Manufacturer shall have minimum ten years' experience in manufacturing bi-Fold doors similar to those indicated for this Project.
- C. Installer Qualifications: Installer shall have minimum ten years' experience in both installation and maintenance of units required for this Project.
- D. Pre-Installation Conference: Schedule a pre-installation conference prior to commencement of field operations that might affect installation of bi-fold doors to establish procedures for maintaining optimum working conditions, and to coordinate this work with related and adjacent work.
- E. The contractor shall touch up all scratches, abrasions or other slight painting defects with the same type and color of paint as originally applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver materials and products in manufacturer's labeled protective packages. Store and handle in strict compliance with manufacturer's written instructions and recommendations. Protect from damage from weather, excessive temperatures and constructions operations.
- C. Inspect vertical bi-fold doors upon delivery for damage. Remove and replace damaged items as directed by Architect.
- D. Store bi-fold door frame units elevated off ground. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately.
- E. Store door components at building site under cover so that they will not be damaged or deformed. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials which might cause staining.

1.7 WARRANTY

- A. The Contractor shall warrant the door to be free of defects in accordance with the General Conditions, except the warranty shall be extended by manufacturer's 2-year written warranty against defects in materials and workmanship, against problems which arise through normal anticipated usage of the door during the warranty period. The warranty shall be signed by the manufacturer.
- B. Additional Warranty On The Straps: In addition to the warranty specified above, the door manufacturer shall warrant the original lift straps for a period of five years for, against defects in material.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 BI-FOLD DOOR

- A. Acceptable Manufacturers:
 - 1. Schweiss Bi-Fold Doors
 - 2. Wilson Doors.
 - 3. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Description: Electrically operated, bi-fold canopy type door.
 - 1. Door size to be approximately 21'-0" wide by 27'-0" high, with clear height of 24 feet with door in open position. Refer to Drawings for exact door and opening dimensions.
 - 2. Provide with single hinge, top drive motor and strap lift type.

2.2 BI-FOLD DOOR FRAMEWORK / FABRICATION REQUIREMENTS

- A. Door shall be hinged horizontally at the top and center, and be arranged to open by moving frame out & up. When in the open position the doors shall have a slight slope to direct drainage away from the building.
- B. Door frames shall have prelocated top hinges to align with the building support points.
- C. The door framework shall consist of welded steel tube sections engineered by the door manufacturer to resist all anticipated loads without sagging, bowing or conflicting with its smooth operation.
- D. Structural steel door framing members shall be ASTM A500 Grade B square structural welded steel tubing.
- E. Shop connections shall be welded and ground smooth.
- F. Field connections shall be bolted.

2.3 DRIVESHAFT / LIFT DRUMS

- A. Solid steel driveshaft with lift drums mounted on bottom cord of door runs continuously along entire door width providing an even lift of the door at all times.
- B. The drive shaft shall be attached to the door frame with bearing mounts wherever there is a cable drum installed, to minimize stress on the shaft.
- C. Solid Driveshaft and lift drums shall be designed to provide a 5:1 safety factor.

2.4 LIFTING METHOD

- A. The door power unit shall be operated by a system of lifting straps, lifting drums and drive shafts.
- B. Lift Straps shall be attached to a retainer on the upper door frame in order to transmit forces directly to header of building and relieve door of unnecessary stresses.
- C. Lift Straps shall have adjustable slack take-up device to keep proper tension on each Lift Strap.
- D. Properly shield the lift Drums to avoid any potential hazards to people.
- E. Lift Straps and Lift Drums shall be manufacturer's standard adequately sized in sufficient amount to give 5:1 safety factor.

2.5 COMPONENTS

- A. Heavy Duty Hinges:
 - 1. Heavy Duty Steel Hinges furnished complete. Each Hinge set shall be 10.50" wide, pins shall be 11/16" diameter minimum.
- B. Door Trusses:
 - 1. Internal Truss: Provide center truss at center of the interior side and a truss at the base of the door to provide extra strength.
- C. Heavy Duty Side Rollers
 - 1. 3" Heavy Duty minimum guide rollers with sealed bearings on bottom of door at jamb location.
- D. Column Followers / Windrails:
 - 1. Provide system to hold the base of the door securely against the building when the door is in the closed position: solid square columns secure only in the closed position.
- E. Wind Pins:
 - 1. Automatic Wind Pins: Center wind pins 1" diameter minimum; must automatically engage/disengage.
- F. Manual Latching Systems:
 - 1. Standard manual latch system shall be provided on both sides of the doors.

2. Furnish manually latching system to require door to be manually unlocked before the door can be opened and manually relocked after the door is in the closed position.

2.6 FINISHING

- A. Door frame members and parts shall be factory primer finished with gray primer.
- B. Interior surfaces to be field painted by Section 09 9000.

2.7 TOP & BOTTOM RUBBER SEALS

- A. Provide manufacturer's standard seal continuous at top and bottom of each door.
 1. Provide neoprene weather stripping at heads and jambs.
 2. Sills shall have fabric reinforced high grade rubber astragal. Entire door perimeter shall be weather tight.
 3. Sides and center of each bi-fold shall be sealed with weather stripping.

2.8 ELECTRIC POWER OPERATOR - TOP DRIVE

- A. Motor shall be located above door.
- B. All electrical controls and devices shall be designed to meet National Electrical Code Section 513.
- C. All controls shall be pre-wired and factory tested.

2.9 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. All electrical controls and devices shall conform to the requirements of the current National Electrical Code 513, NEMA, and be UL approved.
- B. Provide UL Listed Electric Operator, size and type as recommended by the manufacturer.
- C. Provide operator furnished complete and consisting of a motor and factory-wired control panels with main fused disconnect switch, magnetic reversing starters, limit switches and push button controls, control circuit transformers, relays, timing devices, and warning devices.
 1. Service: 240 VAC, single phase, 3 wire service.
 2. Single Phase Motor's shall be totally enclosed capacitor start.
 3. Single phase, 240 volt electric motor with overload protection direct mounted to a gear reduction box and winding drum.
 4. The size of the motor shall be as recommended by the manufacturer.
 5. Door operator shall be pre-wired at factory complete with 24 V.A.C. control
- D. Gear Motor
 1. Provide electric brake to stop and hold door in any position of door travel.
 2. Provide high starting torque, reversible, continuous duty, class A insulated, electric motors complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position.
 3. Provide a magnetic starter, with 24v control unit.

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4. Design operator so motor may be removed without disturbing limit switch adjustment and without affecting emergency auxiliary operator.
- E. Control Station
1. 2 Button Constant Hold Control Station.
 - a. 2-button constant contact dead man switch, which prevents operator from leaving control panel while door is in motion, either up or down.
 - b. Surface mounted. Refer to Drawings for location.
- F. Limit Switches
1. Heavy duty limit switch box shall be weatherproof.
 2. Heavy duty limit switch box shall provide adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 3. Safety edges shall not be used as limit switches.
- G. Electrical Disconnect
1. Provide Electrical Disconnect to completely disable the door, for service, maintenance, emergency backup operations.
 2. Mount disconnect so it is accessible from floor level.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Examine wall and overhead areas, including opening framing and blocking, with installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this section.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 1. Coordinate with other trades in the development of the installation details of the exterior finishes.
 2. Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawing, manufacturer's written instructions, and as specified.
 3. Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track, hinges from structural overhead framing with angle or channel hangers welded and/or bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track, hinges and door-operating equipment.
- B. Top and Bottom Limits Settings

1. Each bi-fold door has a recommended clear opening setting , specified by the manufacture. Do not over travel the door beyond the recommended setting.
- C. Exterior Finish
 1. Insulated metal panels and aluminum glazing system to be installed on exterior face of door. Install the proper trims that are recommended by the manufacturer.
- D. Apply Proper Safety Markings
 1. Apply proper markings for any potentially hazardous locations related to the operation of the door.
- E. Installing Warning Labels
 1. Furnish warning labels for any potentially hazardous locations related to the operation of the door.
 2. Fasten warning labels to the bi-fold door frame and by the operator's station in accordance with manufacturers' instructions.
- F. Installer Certificates: Signed by manufacturer certifying that installers comply w/ specified requirements.

3.3 ELECTRICAL WORK

- A. The contractor is responsible and required to completely install the prewired electrical door operating mechanism, push button controls, devices and electrical conduit & wiring to the door operating controls.
- B. Detail wiring for power, signal, and control systems.
 1. Differentiate between manufacturer-installed and field installed wiring & between components provided by door manufacturer and those provided by others.
- C. Install bi-fold doors in accordance with manufacturers' instructions.

3.4 ADJUST & CLEAN

- A. Lubricate, test adjust doors - to operate easily, free from warp, twist, or distortion and fitting weather tight for entire perimeter.
- B. Prime Coat Touch Up:
 1. Immediately after erection, sand smooth any rusted or damaged areas of prime coat.
 2. Touch-up damaged coating and finishes and repair minor damage.
 3. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned, and apply touch up of compatible air drying primer.
- C. Final Adjustments:
 1. Lubricate bearings and moving parts, adjust open and closed limits & doors to operate easily , free from warp, twist , or distortion and fitting weathertight for the entire perimeter.

2. Check and readjust operating finish hardware items, leaving vertical bi-fold doors undamaged and in complete and proper operating condition.

3.5 DEMONSTRATION

- A. Startup Services: Engage a qualified -authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls & equipment.
 2. Train Owner's maintenance personnel on procedures and schedules related to startup and shut down, operating , troubleshooting, servicing, and preventative maintenance.
 3. Review data in the installation & maintenance manuals.
 4. Schedule training with Owner at least 7 days advance notice

END OF SECTION

SECTION 08 4113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
1. Interior aluminum-framed storefront system including trim.
 2. Frameless glazed storefront.
 3. Selected interior door frames.
 4. Exterior perimeter sealing of storefront units.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 05 1200 - Structural Steel Framing: Steel fabricated attachment members.
 3. Section 07 2600 - Vapor Retarders: Perimeter vapor seal between glazing system and adjacent construction.
 4. Section 07 8400 - Firestopping: Fire stop at system junction with structure.
 5. Section 07 9000 - Joint Protection: System perimeter sealant and back-up materials at interior.
 6. Section 08 4413 - Glazed Aluminum Curtain Walls: Framing for doors..
 7. Section 08 7100 - Door Hardware: Mortised hardware reinforcement requirements affecting framing members; hardware items other than specified in this section and power assisted door openers.
 8. Section 08 8000 - Glazing.
 9. Section 09 9000 - Painting and Coating: Field painting of interior surface of infill panel surfaces.

1.2 REFERENCES

- A. Aluminum Association:
1. AA DAF-45 - Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association:
1. AAMA 501 - Methods of Test for Exterior Walls.
 2. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.
 3. AAMA 503 - Voluntary Specification for Field Testing of Metal Storefronts. Curtain Wall and Sloped Glazing Systems.
 4. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 5. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 6. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

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7. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 8. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 9. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
 10. AAMA MCWM-1 - Metal Curtain Wall Manual.
 11. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.
- C. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 7. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 8. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 9. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 10. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
 11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.
- E. National Fenestration Rating Council Incorporated:
1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.
- F. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- G. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
 2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.
- H. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SYSTEM DESCRIPTION

- A. Aluminum-framed storefront system includes tubular aluminum sections, aluminum and glass entrance doors, shop fabricated, factory finished, glass and glazing, related flashings, anchorage and attachment devices.
- B. System Assembly: Site assembled or shop unitized assembly.
- C. Provide complete watertight assembly meeting specified performance requirements.

1.4 PERFORMANCE REQUIREMENTS

- A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.
 - 1. As calculated in accordance with applicable code, as measured in accordance with ASTM E330.
- B. Deflection: Limit mullion deflection to 1/175 for spans under 13'-6" and 1/240 plus 1/4 inch for spans over 13'-6 of span; with full recovery of glazing materials.
- C. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
- D. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with [inside] pane of glass [and inner sheet of infill panel] and heel bead of glazing compound.
- E. Expansion / Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.
- F. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

1.5 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.
- C. Product Data: Submit component dimensions; describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface, insulated glass units, and infill panels.

- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.7 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.8 QUALIFICATIONS

- A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years documented experience, and with service facilities within 100 miles of Project.

1.9 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Protect finished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.11 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONTS

- A. Acceptable Manufacturers:
 - 1. Kawneer Co., Inc.
 - 2. Tubelite,
 - 3. Vistawall
 - 4. YKK AP America
 - 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements
- B. Framed Storefront System (SF-1):
 - 1. Basis of Design is Kawneer Trifab VG 450.
 - a. Location: West and east atrium walls on Third and Fourth floors and at interior storefront and selected door frames (refer to door schedule for locations).
 - b. At Atrium system is to be flushed glazed from non-atrium side with structural silicone glazed vertical joints.
 - c. Where used for door frames, provide non-glazed door framing to receive wood doors.
 - 2. Non-thermally broken; flush glazing stops.
 - 3. Mullions: Profile of extruded aluminum with internal reinforcement of aluminum or shaped steel structural section.
- C. Frameless Storefront System (SF-2):
 - 1. Custom design with extruded aluminum channels at top and bottom of glazing. Refer to Drawing details for additional information.
 - a. Location: North and south glazed openings in atrium walls on Second, Third and Fourth floors and adjacent to Vestibules on First Floor (refer to Drawings for locations).
 - b. Provide silicone butt glazed vertical joints.

- c. Bottom Channel: 3 7/8" high by 1 3/4" wide, brushed stainless rail.
 - 1) Basis of Design is rail by C.R.Laurence Co., Inc, Model # CR387 Series. (www.crlaurence.com.)
 - d. Size top and bottom channels to receive glass as specified in Section 08 8800.
- D. Exterior and Vestibule Doors: Aluminum framed glass doors
- 1. Basis of Design: Kawneer Medium Stile 350 Heavy Wall Entrances.
 - 2. Description: 2 inches thick door and 3-1/2" vertical stiles and 10-1/4 inch high bottom rail; square glazing stops.
 - 3. Doors for installation in both storefront and curtainwall systems. Refer to Section 08 4413 for curtainwall specifications.

2.2 COMPONENTS

- A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.
- B. Sheet Aluminum: ASTM B209, 5005 alloy, H15 or H34 temper.
- C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.
- D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.
- E. Glass and Glazing Materials: Specified in Section 08 8000.
- F. Hardware:
 - 1. Hinges: Provide manufacturers standard hinges appropriate for conditions illustrated on the Drawings.
 - 2. Weather-stripping: Provide weather stripping at head, jambs, sill and meeting rails at all exterior doors. Weather stripping shall be continuous, vandal-resistant and field –replaceable.
 - 3. Remainder of hardware is provided by Section 08 7100. Coordinate requirements for doors with hardware supplier.
- G. Flashings: Minimum 0.032 inch thick aluminum to match mullion sections where exposed.
- H. Firestopping: As specified in Section 07 8400.
- I. Sealant and Backing Materials:
 - 1. Sealant Used Within System (Not Used for Glazing): Manufacturer's standard materials to achieve weather, moisture, and air infiltration requirements.
 - 2. Perimeter Sealant: Specified in Section 07 9000.
- J. Fasteners: Stainless steel.

2.3 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to conceal from view.
- E. Reinforce interior horizontal head rail to receive [drapery] [blind] track brackets and attachments.
- F. Prepare components with internal reinforcement for door hardware.
- G. Reinforce framing members for imposed loads.

2.4 SHOP FINISHING

- A. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605 three coat system, with minimum 70 percent polyvinylidene fluoride resin.
 - 1. Color: PPG Duranar XL UC51131XL, "Silver".
- B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.
- C. Apply bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar metals.
- D. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.
- E. Extent of Finish:
 - 1. Apply factory coating to surfaces exposed at completed assemblies.
 - 2. Apply finish to surfaces cut during fabrication so no natural aluminum is visible in completed assemblies, including joint edges.
 - 3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify dimensions, tolerances, and method of attachment with other Work.
- C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION

- A. Install wall system in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, [aligning with adjacent Work.
- E. Install integral flashings and integral joint sealers.
- F. Set thresholds in bed of mastic and secure.
- G. Install hardware using templates provided. Refer to Section 08 7100 for installation requirements.
- H. Coordinate installation of glass with Section 08 8000; separate glass from metal surfaces.
- I. Coordinate installation of perimeter sealants with Section 07 9000.

3.3 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
- C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspection to monitor quality of installation and glazing.

3.5 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting and balancing.
- B. Adjust operating hardware [and sash] for smooth operation.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove protective material from pre-finished aluminum surfaces.
- C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Protect finished Work from damage.

END OF SECTION

SECTION 08 4413

GLAZED ALUMINUM CURTAIN WALL

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
1. Aluminum tube frame glazed curtain wall system.
 2. Perimeter trims, stools, accessories, shims and anchors.
 3. Glass and glazing.
 4. Un-insulated metal infill panels.
 5. Integral air barrier and vapor retarder.
 6. Integral firestopping at floor slabs.
 7. Integral and perimeter sealant.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 04 2500 - Unit Masonry Panels: Stone for infill panels.
 3. Section 05 1200 - Structural Steel Framing: Steel fabricated attachment members.
 4. Section 07 2600 - Vapor Retarders: Perimeter vapor seal between curtain wall system and adjacent construction.
 5. Section 07 8400 - Firestopping: at locations other than curtain wall to floor slabs.
 6. Section 07 9000 - Joint Protection: Joint sealers other than those integral with curtain wall.
 7. Section 08 4113 - Aluminum-Framed Entrances and Storefronts: Storefront systems including entrance doors, frames, and glazed lights.
 8. Section 08 4433 - Sloped Glazing Assemblies: Framed, sloped glass system.
 9. Section 08 7100 - Door Hardware: Hardware reinforcement requirements affecting curtain wall framing members.
 10. Section 08 8000 - Glazing: Glass and glazing not integral with curtain wall system.
 11. Section 08 9100 – Louvers: Custom extrusions at perimeter of louvers to match curtainwall systems.
 12. Section 09 2116 - Gypsum Board Assemblies: Metal stud and gypsum board sheathing at interior of curtain wall system and secured to mullions.
 13. Section 09 9000 - Painting and Coating: Field painting of interior surface of infill panel surfaces.

1.2 REFERENCES

- A. Aluminum Association:
1. AA DAF-45 - Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association:
1. AAMA 501 - Methods of Test for Exterior Walls.
 2. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.

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3. AAMA 503 - Voluntary Specification for Field Testing of Metal Storefronts. Curtain Wall and Sloped Glazing Systems.
 4. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 5. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 6. AAMA 1801 - Voluntary Specification for the Acoustical Rating of Windows, Doors and Glazed Wall Sections.
 7. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 8. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 9. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 10. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
 11. AAMA CW-11 - Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing.
 12. AAMA CW-DG-1 - Aluminum Curtain Wall Design Guide Manual.
 13. AAMA MCWM-1 - Metal Curtain Wall Manual.
 14. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.
- C. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 7. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 8. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 9. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 10. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
 11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.
- E. National Fenestration Rating Council Incorporated:

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- 1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.
 - F. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 - G. SSPC: The Society for Protective Coatings:
 - 1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
 - 2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.
 - H. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SYSTEM DESCRIPTION

- A. Curtain Wall System: Tubular aluminum sections with self-supporting and supplementary support framing, factory prefinished, glass and glazing, metal panel spandrel infill, related joint sealers, flashings, anchorage and attachment devices.
 - 1. System to be reglazable from exterior, except at system CW-3.
- B. System Assembly: Site assembled or shop unitized assembly.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall, including building corners.
 - 1. As calculated in accordance with applicable code, as measured in accordance with ASTM E330.
- B. Deflection: Limit mullion deflection to 1/175 for panes under 13'-6" and 1/240 plus 1/4" for spans over 13'-6" with full recovery of glazing materials.
- C. System Assembly: Accommodate following without damage to system, components or deterioration of seals.
 - 1. Movement within system.
 - 2. Movement between system and perimeter framing components.
 - 3. Dynamic loading and release of loads.
 - 4. Deflection of structural support framing.
 - 5. Tolerance of supporting components.
 - 6. Shortening of building concrete structural columns.
 - 7. Creep of concrete structural members.
 - 8. Interstory drift.
- D. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance shall not be more than: 0.36.
- E. Air Infiltration: Limit air infiltration through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of 6.24 psf as measured in accordance with ASTM E283.

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- F. Condensation Resistance Factor: When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 72 for frame and glass.
 - G. Expansion / Contraction: System to provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental affect to system components.
 - H. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.
 - I. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapor retarder.
 - J. Window Washing Accessories: Reinforce curtain wall system to accommodate window washing guide system components. Provide anchors sufficiently rigid to resist loads caused by equipment platform, without damage to wall system.
 - K. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

1.5 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related work, weep drainage network, expansion and contraction joint location and details, and field welding required.
 - 1. Include shop and field sealants by manufacture and product name, and locate on drawings. Show sealant joint sizes, including tolerances and maximum/minimum joint sizes required.
- C. Product Data: Submit component dimensions; describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
- D. Samples: Submit two 12 x 12 inches in size indicating prefinished aluminum surface, specified glass, infill panels, glazing materials illustrating edge and corner.
- E. Design Data: Indicate framing member structural and physical characteristics, loading criteria and dimensional limitations. Submit calculations prepared by a professional engineer licensed in the State of Minnesota.
- F. Test Reports: Indicate substantiating engineering data, test results of previous tests by independent laboratory that purport to meet performance criteria, and other supportive data.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Installation Data: Special installation requirements.

1.6 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

- B. Surface Burning Characteristics:
 - 1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

- C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.8 QUALIFICATIONS

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

- B. Installer: Company specializing in performing Work of this section with minimum ten years experience and approved by manufacturer.

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- C. Design structural support framing components under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Minnesota.

1.9 MOCKUP

- A. Section 01 4000 - Quality Requirements: Requirements for mockup.
- B. Construct mockup, 8'-0" feet wide (equivalent to one bay) mockup including intermediate mullion, perimeter mullion, sill, vision glass light, and spandrel panel. And metal infill panel. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
- C. Locate where directed by General Contractor.
- D. Remove mockup when directed by Architect/Engineer.

1.10 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.11 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Handle Work of this Section in accordance with AAMA MCWM-1 - Curtain Wall Manual.
- C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle material and components to avoid damage. Protect curtain wall material against damage from elements, construction activities, and other hazards before, during and after curtain wall installation.

1.12 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.13 COORDINATION

- A. Coordinate Work under provisions of Section 01 3000.

1.14 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.

- B. Manufacturer's Product Warranty: Submit, for Owner's acceptance, manufacturer's warranty for curtain wall system as follows:
1. Material & Workmanship Warranty Period: Two (2) years from Date of Substantial Completion of the project, except as noted below:
 2. Furnish manufacturer's ten-year fluoropolymer paint finish warranty.

PART 2 PRODUCTS

2.1 CURTAIN WALL SYSTEM

- A. Acceptable Manufacturers:
1. EFCO Corp.
 2. Kawneer Co. Inc;
 3. Wausau Metals.
 4. YKK AP America, Inc.
 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Product Description:
1. Basis of Design: Kawneer 1600 Wall Systems 1, 2, 3 and Interface Veneer.
 2. Glazed aluminum curtain wall, thermally broken with interior 2-1/2" by 6" tubular sections insulated from exterior glass retaining member.
 3. Provide matching covers, stops and glass retaining member of sufficient size and strength to provide bite on glass and infill panels; drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.
 4. Provide exterior trim per the following:
 - a. Curtainwall System CW-1
 - 1) Horizontal Mullions: No snap cover (SSG).
 - 2) Vertical Mullions: 'Profile 1" custom snap cover. Refer to Drawings for details.
 - 3) Location: Entry curtainwalls.
 - 4) Finish / Color: Color: PPG Duranar XL UC51131XL, "Silver".
 - b. Curtainwall System CW-2
 - 1) Horizontal Mullions: No snap cover (SSG)..
 - 2) Vertical Mullions: 'Profile 2" custom snap cover. Refer to Drawings for details.
 - 3) Location: Curtainwall in masonry walls.
 - 4) Finish / Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
 - c. Curtainwall System CW-3A
 - 1) Perimeter Mullions: Manufacturers standard snap cover.
 - 2) Vertical Mullions: No snap cover (SSG).
 - 3) Location: Entry Vestibules.
 - 4) Finish / Color: Color: PPG Duranar XL UC51131XL, "Silver".
 - d. Curtainwall System CW-3B
 - 1) Perimeter Mullions: 'Profile 1" custom snap cover. Refer to Drawings for details.
 - 2) Vertical Mullions: No snap cover (SSG).
 - 3) Location: First Floor conference rooms.

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- 4) Finish / Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
 - e. Curtainwall System CW-4
 - 1) Mullions: No snap covers (4 sided SSG); with 1 1/8" infill trim at perimeter.
 - 2) Location: Adjacent to hangar door.
 - 3) Finish / Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
 - f. Curtainwall System CW-5.
 - 1) Kawneer 1600 Interface Veneer; total system depth of 2- 3/8" inches. Thermally broken mullions, 2-1/2" wide.
 - 2) Mullions: No snap covers (4 sided SSG) with 1 1/8" infill trim at perimeter.
 - 3) Location: Hangar Door glazing.
 - 4) Finish / Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
- C. Reinforced Mullion (if required): Extruded aluminum cladding with internal reinforcement of shaped steel structural section.

2.2 COMPONENTS

- A. Extruded Aluminum: ASTM B221; 6063 alloy-T6 alloy and temper. Each framing member shall have a wall thickness sufficient to meet the specified structural requirements.
- B. Sheet Aluminum: ASTM B209, 3003 or 5005 alloy, H15, H16, or H34 temper.
- C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.
- D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.
- E. Glass: Specified in Section 08 8000.
- F. Glazing Materials: As specified in Section 08 8000.
- G. Metal Infill Panels (MWP-2):
 - 1. At Curtainwall Type CW-2:
 - a. Exterior Face: Stainless steel panel, 12 ga, Type 304; brushed finish.
 - b. Panel System: Exterior face panel over 1" rigid insulation over 12 gauge aluminum backer panel.
 - c. Panel to be 'glazed' into framing with thermal insulation and aluminum back closure panel provided on interior face.
- H. Sealant and Backing Materials:
 - 1. Sealant Used Within System (Not Used for Glazing): Manufacturer's standard materials to achieve weather, moisture, and air infiltration requirements.
 - 2. Perimeter Sealant: Specified in Section 07 9000.
 - 3. Backing Material: 1 inch rigid insulation.
- I. Flashings: Minimum 0.032 inch thick aluminum to match curtain wall mullion sections where exposed.

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1. Secure flashings with concealed fastening method.
- J. Transition Assembly; Tremco Proglaze ETA, System 3 – Pressure Bar Application.
 1. System is comprised of a silicone rubber extrusion, silicone rubber corners and silicone sealant.
 2. Use: To provide a continuous barrier between the curtain wall openings and the adjacent air and vapor barrier materials.
 - K. Firestopping: Thermafiber, "FireSpan90". Firestopping shall comply with requirements as specified in Section 07 8400.
 - L. Board Insulation: Mineral Fiber Board as specified in Section 07 2113.
 - M. Vapor Retarder: Specified in Section 07 2600.
 - N. Fasteners: Where exposed, shall be stainless steel.

2.3 FABRICATION

- A. Fabricate system components per manufacturer's installation instructions with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to conceal from view.
- E. Reinforce interior horizontal head rail to receive [drapery] [blind] track brackets and attachments.
- F. Reinforce framing members for external imposed loads.

2.4 SHOP FINISHING

- A. Painted Aluminum Surfaces: AA-M12C12R1x non-specular as fabricated mechanical finish, chemically cleaned, and prepared for applied coating; with organic coating.
 1. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605, multi coat system, with minimum 70 percent polyvinylidene fluoride resin.
 2. Colors: As noted in Product Description above.
- B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.
- C. Apply bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.
- D. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.

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- E. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.
 - F. Extent of Finish:
 - 1. Apply factory coating to surfaces exposed at completed assemblies.
 - 2. Apply finish to surfaces cut during fabrication so no natural aluminum is visible in completed assemblies, including joint edges.
 - 3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify wall openings and adjoining air barrier and vapor retarder materials are ready to receive Work of this section.

3.2 INSTALLATION

- A. Install wall system in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
- E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent Work.
- F. Provide thermal isolation where components penetrate or disrupt building insulation.
- G. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.
- H. Install sill flashings. Turn up ends and edges; seal to adjacent Work to form watertight dam.
- I. Install firestopping at each floor slab edge. Comply with applicable codes and requirements specified in Section 07 8400.

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- J. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
 - K. Install glass and infill panels to achieve performance criteria conforming with installation requirements specified in Section 08 8000.
 - L. Install perimeter sealant to method required to achieve performance criteria conforming to installation criteria specified in Section 07 9000.
 - M. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.

3.3 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.
- C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
- D. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
 - 1. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment.
 - a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft², which ever is greater.
 - b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 10 psf (479 Pa).
- C. Perform one test each at 10%, 50% and 80% of curtain wall completion, with repeat tests when failures occur.
- D. When testing results in leakage, eliminate causes of leaks and retest until no leaks occur.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Section 01 4000 - Quality Requirements: Manufacturers' field services.
- B. Curtain wall and glass product manufacturers to provide field surveillance of installation of their Products.
- C. Monitor and report installation procedures and unacceptable conditions.

3.6 PROTECTION AND CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction and final cleaning.
- B. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.
- C. Remove protective material from prefinished aluminum surfaces.
- D. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

SECTION 08 6300

METAL-FRAMED SKYLIGHTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Engineering, fabrication and erection of extruded aluminum framed skylights.
 - 2. Skylight glazing system.
 - 3. Fasteners, anchors, reinforcement, and flashings.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 1200 - Structural Steel Framing: Structural support framing for system.
 - 3. Section 05 5000 - Metal Fabrications: Fabricated steel.
 - 4. Section 07 2600 - Vapor Retarders: Edge conditions at roof penetrations.
 - 5. Section 07 6200 - Sheet Metal Flashing and Trim: Skylight counter flashing.
 - 6. Section 07 8400 - Firestopping.
 - 7. Section 07 9000 - Joint Protection.
 - 8. Section 08 8000 - Glazing: Glass and glazing not integral with metal-framed skylights.

1.2 REFERENCES

- A. Aluminum Association:
 - 1. AA DAF-45 - Designation System for Aluminum Finishes.

- B. American Architectural Manufacturers Association:
 - 1. AAMA 501 - Methods of Test for Exterior Walls.
 - 2. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 3. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - 4. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - 5. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 6. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

- C. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 6. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
 7. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 8. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
 9. ASTM D635 - Standard Test Method for Rate of Burning [and] [or] Extent and Time of Burning of Plastics in a Horizontal Position.
 10. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
 11. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
 12. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 13. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 14. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 15. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
- D. Federal Specification Unit:
1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- E. Green Seal:
1. GC-03 - Anti-Corrosive Paints.
- F. South Coast Air Quality Management District:
1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.3 SYSTEM REQUIREMENTS

- A. Design Requirements:
1. Extruded aluminum members with a system for attachment of exterior glass retainers with snap-on caps.
 2. Condensation guttering system integral with skylight framing members for positive drainage of condensation.
 3. Flush glazed exterior horizontal joints with field applied structural silicone.
 4. Full silicone wet seals along both sides of all exterior glass retainers.
- B. Structural Design: Size components to withstand loads as required by applicable building code. Design skylight to be self-supporting between the building structural support components.
1. Deflection: Deflection of the framing member in a direction normal to the plane of glass when subjected to a uniform load deflection test in accordance with

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- ASTM E330, and per the above specified loads, shall not exceed L/175, up to 1-in. maximum. For clear deflection of a framing member in a direction parallel to the plane of glass, when carrying its full dead load, shall not exceed an amount which will reduce the glass or panel bite below 75% of the design dimension and the member shall have a 1/8-in. minimum clearance between itself and the edge of the fixed panel, glass, or component immediately adjacent, nor shall it impair the function of or damage any joint seals.
2. Movement: Design system to limit stress on elastomeric sealants to 20 percent of tested tensile adhesion and maximum compression or elongation to 25 percent of neutral dimension.
 3. Expansion / Contraction: Design system to accommodate thermal expansion and contraction over ambient temperature range of 100 degrees F, dynamic loading and release of loads [, creep of concrete structural members], and deflection of structural support framing without damage to skylight system components or loss of weather tightness.
- C. Thermal Resistance of Assembly: Maximum U Value of 0.45 Btu/sq ft per hour per deg F when measured in accordance with AAMA 1503.
- D. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft for glazed area, measured at reference differential pressure across assembly of 6.24 psf in accordance with ASTM E283.
- E. Water Leakage: No water penetration shall occur when the system is tested in accordance with ASTM E331 using a differential static pressure of (20% of the inward acting design wind load pressure, but not less than (12 psf).
- F. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate the following:
1. Framed opening requirements and tolerances.
 2. Spacing of members.
 3. Framing member profiles.
 4. Anticipated deflection under load.
 5. Expansion and contraction joint locations and details.
 6. Identification of shop and field welds by AWS Welding Symbols, A2.0.
- C. Product Data: Submit manufacturer's specifications, standard details, and installation requirements.
- D. Samples:
1. Submit two 12-in. x 12-in. samples of each type of glass.
 2. Submit two manufacturer's samples of each type of sealant.
 3. Submit two 6-in. long samples of extrusions (with specified finish).

- E. Test Reports: Indicate substantiating engineering data, certification that the insulating glass units will withstand the specified design loads, test results of previous testing of similar assemblies meeting performance criteria, and other supporting data.
- F. Design Calculations: Submit calculations and related details prepared, sealed, and signed by registered design professional licensed to practice structural engineering in the State of Minnesota.
 - 1. Prepare calculations prepared in accordance with the Aluminum Association's Specifications for Aluminum Structures (SAS30).
- G. Manufacturer's Installation Instructions: Submit special procedures, safety precautions, and perimeter conditions requiring special attention.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
- D. VOC Content of Paints and Coatings: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience and approved by manufacturer.
- C. Design framed skylight system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Minnesota.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Provide wrapping or strippable material to protect prefinished aluminum surfaces. Do not use adhesive papers or spray coatings that bond when exposed to sunlight or weather.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with installation of roofing system [and structural curb].
- C. Coordinate the Work with continuity of vapor retarder specified in Section 07 2600.

1.10 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish a written warranty certifying that all skylight work was furnished and installed in complete accordance with the Contract Documents.
- C. Certify that skylight frame is free of defects in design, material, and construction for a period of ten (10) years from the Date of Skylight Completion.
- D. Provide warranty against defective materials, delamination, seal failure and defects in manufacture, for a period of ten (10) years from the date of acceptance of the skylight installation. Should any defects develop during the guarantee period due to improper workmanship or materials, such defects will be repaired by the skylight subcontractor at no expense to the Owner.

PART 2 PRODUCTS

2.1 METAL-FRAMED SKYLIGHTS

- A. Basis for Design: Contract documents were developed based on the Basic Glazing System with 350 Series components, manufactured by Super Sky Products.
 - 1. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Product Description: Refer to Drawings for scope and details.
 - 1. Skylight Frame: Extruded aluminum structural members with integral condensation collection and guttering system thermally separated from exterior metal components.
 - 2. Glazing System: Mechanically retained glazing system for vertical joints and structural adhesive glazing for horizontal joints.
 - 3. Glazing: Insulating glass.

2.2 COMPONENTS

- A. Aluminum Extrusions: 6063-T5, 6063-T6, or 6061-T6 members complying with ASTM B221.
 - 1. Principal Supporting Members: .125-in. minimum thickness extruded aluminum. Sizes, shapes and profiles as indicated on the Contract Drawings.
 - 2. Snap-on Covers and Miscellaneous Non-supporting Trim: .062-in. minimum thickness extruded aluminum, alloy 6063-T5.
 - 3. Supporting aluminum gutters: thickness as prescribed by skylight engineer, based on skylight reactions and applied design loads.
 - 4. Formed Aluminum: .125-in. minimum thickness aluminum sheet material of alloy 5052, 5005, or 6061-T6 complying with ASTM B209.
- B. Glazing Strips:
 - 1. Extruded EDPM rubber designed to comply with the following specifications:
 - a. Hardness: ASTM D2240, Type A: Durometer 50 (+/-5).
 - b. Tensile Strength: ASTM D412. 800 psi (min.).
 - c. Elongation: 300% (min.).
 - d. Color: Black.
 - 2. Compression Set: ASTM D395 Method B, 22 hours @ 212 °F: 25% (max.).
 - 3. Heat Aging Characteristics:
 - a. 70 hours @ 212 °F.
 - b. Hardness: ASTM D2240, Type A: Durometer 50 (+/-5).
 - c. Tensile Change: ASTM D412. -10%.
 - d. Elongation Change: ASTM D412: -20%.
 - 4. ASTM D1171 Weather Resistance at 1 Part Ozone per Million, 500 hours at 20% Elongation: No cracks.
 - 5. No visual checks, cracks or breaks after completion of tests.
- C. Setting Blocks:
 - 1. Extruded Type II silicone rubber designed to permit adhesion and comply with the following specifications:
 - a. Hardness: ASTM D2240, Type A: Durometer 80 (+/-5).
 - b. Color: Black.

- D. Glass: Glass Type GL-6 (Insulated Laminated Silkscreen Vision Glass) as specified in Section 08 8000.
- E. Structural Sealant: High performance silicone sealant applied in accordance with manufacturer's recommendations.
 - 1. Hardness: ASTM D2240 Type A, 30 durometer.
 - 2. Ultimate Tensile Strength: ASTM D412, 170 psi.
 - 3. Tensile at 150% Elongation: ASTM D412, 80 psi.
 - 4. Joint Movement Capability after 14 Day Cure: ASTM C719, +/- 50%.
 - 5. Peel Strength (aluminum, glass, concrete) after 21 Day Cure: ASTM C794, 50 ppi.
- F. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- G. Perimeter Sealant: Specified in Section 07 9000.

2.3 ACCESSORIES

- A. Glazing Accessories: As recommended by manufacturer of skylight system conforming to requirements specified in Section 08 8000.
- B. Flashings: Minimum 0.062-inch thick aluminum, with same finish as system components; secured with concealed fastening method.
- C. Touch-Up Primer for Galvanized Steel Surfaces: Zinc rich type.
 - 1. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
- D. Protective Coating: Bituminous coating, FS TT-C-494, Type II.
- E. Fasteners: Non-corrosive type as recommended by skylight manufacturer.
- F. Anchorage Devices: Type recommended by manufacturer, concealed.

2.4 FABRICATION

- A. Form skylight rafters as indicated on Drawings.
- B. Construct skylight(s) using extruded aluminum members and a continuous aluminum curb with expansion joints as required.
- C. Fit and assemble work in the manufacturer's shop to the greatest extent possible. Work that cannot be permanently assembled shall be shop-assembled, marked, and disassembled before shipment to the jobsite.
- D. Fit and secure joints and corners with [screw and spline] [internal reinforcement]. Make joints rigid, with connections that are flush, hairline, and weatherproof.
- E. Design glass retainer fasteners to resist uplift loadings. Spacing to be determined by structural calculations, when applicable.

- F. Use snap-on caps to conceal glass retainers and glass retainer fasteners.
- G. Shop locate, drill and bolt, or weld aluminum clips to framing members.
- H. Set glass with interior and exterior EDPM glazing strips.
- I. Use silicone setting blocks to support glass and to provide edge clearances and glass bites as outlined below, in accordance with FGMA recommendations:
 - 1. Set blocks not less than 6-in. from edge of glass for support unit.
 - 2. Glass Bite: not less than 1/2-in. or more than 5/8-in. on any side of glass unit.
 - 3. Maintain 1/4-in. edge clearance between glass and adjacent metal framework.
 - 4. Use rubber spacers to maintain separation of glass and adjacent metal framework.
- J. Locate weepholes in curb to positively drain condensation to exterior of skylight at each rafter connection.
- K. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.
- L. Maintain continuous air and vapor retarder throughout assembly, with retarder plane aligned with inside pane of glazing continuing to heel bead of glazing sealant.
- M. Drain water entering exterior joints, condensation occurring in glazing channels, and migrating moisture occurring within system, to exterior.
- N. Prepare components to receive [concealed] anchorage devices. Ensure that fasteners will be concealed upon completion of installation.
- O. Adhere glazing frames to glass with structural sealant and cure under controlled conditions in shop. Field glazing of frames to glass is not acceptable.

2.5 FACTORY FINISHING

- A. Exposed metal finish interior and exterior to comply with the following:
 - 1. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2605 three coat system, with minimum 70 percent polyvinylidene fluoride resin.
 - 2. Color: PPG Duranar XL UC51131XL, "Silver".
- B. Galvanizing: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.
- C. Galvanizing for Nuts, Bolts and Washers: ASTM A153/A153M.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

- B. Verify structural curb is ready to receive skylight system. Coordinate installation of roofing and other adjacent Work to ensure weather tight construction.

3.2 PREPARATION

- A. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for the prevention of electrolytic action and corrosion.

3.3 INSTALLATION

- A. Set skylight structure plumb, level, and true to line, without warp or rack of frames or glazing panels. Anchor securely in place in strict accordance with approved shop drawings.
- B. Maintain assembly dimensional tolerances, aligning with adjacent Work.
- C. Apply minimum 1 coat of bituminous coating to concealed aluminum [and steel] surfaces in contact with dissimilar metals.
- D. Install sill flashings.
- E. Pack fibrous insulation in shim spaces at perimeter of assembly to ensure continuity of thermal barrier.
- F. Install glazing in accordance with Section 08 8000 and in accordance with manufacturer's recommended procedures.
- G. Seal horizontal joints between glass panels and wet seal joints between snap-on cap retainers and glass. Apply sealing materials in strict accordance with sealant manufacturer's instructions.
 - 1. Before application, remove mortar dirt, dust, moisture and other foreign matter from surfaces it will contact.
 - 2. Mask adjoining surfaces to maintain a clean and neat appearance.
 - 3. Tool sealing compounds to fill the joint and provide a smooth finish.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation from Plumb, Level, or Line: 1/8 inch per 12 feet, or 1/2 inch in total length.
- C. Maximum offset from true alignment between two members abutting end-to-end, edge-to-edge in line or separated by less than 3-in.: 1/32-in.
- D. Alignment of Two Adjoining Members Abutting in Plane: Within 1/16 inch.

3.5 FIELD QUALITY CONTROL

- A. Perform one field water test in compliance with AAMA 501 on each completed skylight.
 - 1. There shall be no uncontrolled water leakage as defined in AAMA 501.2.

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2. Tests are to be conducted upon completion of the installation with no remobilization or down time included to accommodate either water supply availability or witness personnel schedules.
 3. Testing is to be performed by the manufacturer's authorized personnel.
 4. Independent laboratory testing and reports, if required, are to be ordered and directed by the Owner and/or General Contractor.
- B. When testing results in leakage, eliminate causes of leaks and retest until no leaks occur.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove protective material from prefinished aluminum surfaces.
- C. Wash down exposed surfaces; wipe surfaces clean.
- D. Remove excess sealant by methods recommended by skylight manufacturer.
- E. Touch up damaged finishes so repair is imperceptible from 10 feet. Remove and replace components that cannot be satisfactorily touched up.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

TO BE ISSUED BY ADDENDUM

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
1. Glass glazing for metal frames, doors, windows, and glazed walls.
 2. Glass glazing for handrail balusters.
 3. Glass and glazing materials and installation requirements for other sections referencing this section.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 07 2600 - Vapor Retarders.
 3. Section 07 9000 - Joint Protection: Sealant and back-up material other than glazing sealants.
 4. Section 08 1113 – Hollow Metal Steel Doors and Frames: Glazed doors.
 5. Section 08 4113 - Aluminum-Framed Entrances and Storefronts.
 6. Section 08 4413 - Glazed Aluminum Curtain Walls.
 7. Section 08 6300 - Metal-Framed Skylights.
 8. Section 08 8300 - Mirrors: Frameless mirrors.
 9. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Metal framed mirrors.

1.2 REFERENCES

- A. American National Standards Institute:
1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.
- B. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International:
1. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 3. ASTM C1036 - Standard Specification for Flat Glass.
 4. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 5. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
 6. ASTM C1193 - Standard Guide for Use of Joint Sealants.
 7. ASTM D4802 - Standard Specification for Poly (Methyl Methacrylate) Acrylic Plastic Sheet.
 8. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 9. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 10. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.

11. ASTM E546 - Standard Test Method for Frost Point of Sealed Insulating Glass Units.
 12. ASTM E576 - Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position.
 13. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Exterior Windows and Doors.
 14. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation
- D. Consumer Product Safety Commission:
1. CPSC 16 CFR 1201 – Category II, Impact Test Standard.
- E. Glass Association of North America:
1. GANA - FGMA Sealant Manual.
 2. GANA - Glazing Manual.
 3. GANA - Laminated Glass Design Guide.
- F. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
 2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
 3. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.
- G. Underwriters Laboratories Inc.:
1. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
 2. UL - Building Materials Directory.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:
1. In conjunction with materials described in Section 07 2600 and 07 9000.
 2. To utilize inner pane of multiple pane sealed units for continuity of air barrier and vapor retarder seal.
 3. To maintain continuous air barrier and vapor retarder throughout glazed assembly from glass pane to heel bead of glazing sealant.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data:
1. Glass: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
 2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.
- C. Samples:
1. Glass: Submit two samples, 12 x12 inch in size, illustrating each glass unit type listed in Section 3.8 – Schedule.
 2. Glazing Materials: Submit 6 inch long bead of glazing sealant and gaskets, color as selected.

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- D. Certificates: Certify products meet or exceed specified requirements.
 - E. Manufacturer's Certificate: Certify sealed glass meets or exceeds specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials): For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with [GANA Glazing Manual] [, GANA Sealant Manual] [, GANA Laminated Glass Design Guide] for glazing installation methods.

1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.

- B. Do not install glazing when ambient temperature is less than 50 degrees F.
- C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish ten year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
- C. Furnish ten year warranty to include coverage for delamination of laminated glass and replacement of same.

PART 2 PRODUCTS

2.1 GLAZING

- A. Acceptable Glass Suppliers:
 - 1. PPG Industries.
 - 2. Viracon, Inc
 - 3. Guardian Industries.
 - 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Refer to Paragraph 3.8 - Schedule, for glazing unit types.
- B. Flat Glass: 1/4 inch unless otherwise indicated.
 - 1. Clear Float Glass: ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
 - 2. Clear Heat Strengthened Glass: ASTM C1048, Kind HS, heat strengthened, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
 - 3. Low E Clear Float Glass: Clear float glass, with low emissivity coating on inner surface. Equivalent products by acceptable glass suppliers will be considered under provisions of Section 01 1600.
 - 4. Low E Clear Heat Strengthened Glass: Clear heat strengthened, with low emissivity coating on Number 2 surface.
 - 5. Patterned Glass ASTM C1048, Kind HS heat strengthened, Condition A uncoated, Type II patterned and wired flat, Class 1 translucent, Quality q7 decorative, Finish f1 patterned one side.
 - a. Refer to glazing unit types for frit patterns.
 - 6. Spandrel Coated Glass: ASTM C1048 Kind HS heat strengthened, Condition C other coated glass; coat back (Number 2) surface.
 - a. Refer to glazing unit types for spandrel type and color.

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- C. Safety Glass: Conform to ANSI Z97.1. In addition, all glazing shall pass the test requirements of CPSC 16 CFR 1201, per UBC Chapter 2406. Minimum thickness 1/4 inch unless otherwise indicated.
1. Clear Tempered Glass: ASTM C1048, Kind FT Fully tempered, Condition A, uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
 2. Clear Laminated Glass (Interior Applications): ASTM C1172, Kind LA, clear float glass (Type FG-CF) with plastic interlayer.
 - a. Plastic Interlayer: Manufacturer's standard, minimum 0.030 inch thick.
 3. Clear Laminated Glass (Exterior Applications): Kind LHS, clear heat strengthened glass (Type FG-CH); with plastic interlayer.
 - a. Plastic Interlayer: Manufacturer's standard, minimum 0.060 inch thick.

2.3 ACCESSORIES

- A. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, laminated glass core, insulating glass seals, and glazing channels where applicable.
1. Silicone Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; [chemical] [solvent] curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.
 - a. Color: As selected.
 - b. Structural Silicone: Furnish high-modulus structural silicone glazing materials where sealant bonds glass to substrate.
 2. Polysulfide Glazing Sealant: ASTM C920, Type M, Grade NS, Class and Use suitable for glazing application indicated; two component; chemical curing, non-sagging type; cured Shore A hardness of 15 to 25.
 - a. Color: As selected.
 3. Polyurethane Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.
 - a. Color: As selected.
- B. Glazing Spacers: Metal spacer for interpane space of insulated units.
1. Color: As selected.
- C. Glazing Splines: ASTM C864, resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot.
1. Color: As selected.
- D. Pre-Formed Glazing Tape: Size to suit application.
1. Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
 - a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.
- E. Setting Blocks: ASTM C864, Neoprene, 80 to 90 Shore A durometer hardness, size as recommended by glass manufacturer.
- F. Spacer Shims: ASTM C864 Option, Neoprene, 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of glazing stop x thickness to suit application, self adhesive on one face.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Provide shop testing for safety glass.
- B. Test samples in accordance with ANSI Z97.1, ASTM E2190, ASTM E546, and ASTM E576.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify openings for glazing are correctly sized and within acceptable tolerance.
- C. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement; weeps are clear, and ready to receive glazing.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
 - 1. Glazing Sealants: Comply with ASTM C1193.
 - 2. Fire Rated Openings: Comply with NFPA 80.
- B. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
 - 1. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with compatible butyl sealant.
 - 2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
 - 3. Place setting blocks at 1/4 or 1/3 points with edge block no more than 6 inches from corners.
 - 4. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
 - 5. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line.
 - 6. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
 - 7. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.
- C. Exterior Wet Method (Sealant and Sealant) Installation:

1. Place setting blocks at [1/4] [1/3] points and install glazing pane or unit.
 2. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inches intervals, 1/4 inch below sight line.
 3. Fill gaps between glazing and stops with elastomeric glazing sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.
 4. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.
- D. Interior Butt Glazed Method (Sealant Only) Installation:
1. Temporarily brace glass in position for duration of glazing process. Mask edges of glass at adjoining glass edges and between glass edges and framing members.
 2. Temporarily secure small diameter non-adhering foamed rod on back side of joint.
 3. Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod. Tool sealant surface smooth to concave profile.
 4. Permit sealant to cure then remove foam backer rod. Apply sealant to opposite side, tool smooth to concave profile.
 5. Remove masking tape.
- E. Interior Dry Method (Tape and Tape) Installation:
1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
 2. Place setting blocks at 1/4 or 1/3 points with edge block no more than 6 inches from corners.
 3. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
 4. Place glazing tape on free perimeter of glazing in same manner described above.
 5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
 6. Knife trim protruding tape.
- F. Interior Wet/Dry Method (Tape and Sealant) Installation:
1. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.
 2. Place setting blocks at 1/4 or 1/3 points with edge block no more than 6 inches from corners.
 3. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
 4. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
 5. Fill gaps between pane and applied stop with elastomeric glazing sealant to depth equal to bite on glazing, to uniform and level line.
 6. Trim protruding tape edge.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements. Field inspecting, testing, adjusting, and balancing.

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- B. Monitor quality of glazing.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Section 01 4000 - Quality Requirements: Manufacturers' field services.
- B. Monitor and report installation procedures, and unacceptable conditions.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after Work is complete.
- D. Clean glass and adjacent surfaces.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. After installation, mark pane with an 'X' by using removable plastic tape or paste. [Do not mark heat absorbing or reflective glass units.]

3.8 SCHEDULE - GLAZING UNIT TYPES

- A. Refer to Drawing elevations to locate glazing unit types.
- B. Type GL-1 (Insulated Vision Glass Units): Total unit thickness 1 inch.
 - 1. Double Pane Insulated Glass Units: ASTM E2190; Low E with edge seal; purge interpane space with Argon.
 - a. Acceptable clear low iron glass types:
 - 1) Basis of Design: VE 24-2M Insulating HS/HS as manufactured by Viracon.
 - 2) Solarban 60 Starfire as manufactured by PPG.
 - 2. Insulated Glass Unit Edge Seal Construction: As recommended by the manufacturer to meet the specified warranty.
 - 3. Heat Strengthened where required.
- C. Type GL-1A (Insulated Laminated Vision Glass Units): Total unit thickness 1 inch.
 - 1. Glass type GL-1 with laminated glass with clear pvb interlayer.
 - 2. For glazing system mounted on hangar door.
- D. Type GL-2 (Insulated Silkscreened Vision Glass Units): Total unit thickness 1 inch.
 - 1. VE 24-2M insulating units with patterned frit on #2 surface.
 - 2. Frit pattern: Viracon #5960 #2.
 - 3. Ceramic Frit Color: Viraspan V175 – High Opacity White
 - 4. Refer to Drawings for limits of frit pattern within individual glazed units.

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- E. Type GL-3 (Insulated Glass Spandrel Units): Total nominal unit thickness of 1 inch.
1. VE 24-2M insulating units with heat strengthened float glass and ceramic frit on #4 surface.
 2. Ceramic Frit Color: Viraspan V175 – High Opacity White
 3. Insulated Glass Unit Edge Seal Construction: As recommended by the manufacturer to meet the specified warranty.
- F. Type GL-4 (Insulated Vision Glass Units with Metal Backpan): Total nominal glass unit thickness of 1 inch.
1. Glass Type GL-1 plus airspace and composite metal backpan at back edge of mullions (provided by curtainwall supplier)
- G. Type GL-5 (Insulated Silkscreened Vision Glass Units with Metal Backpan): Total glass unit thickness 1 inch.
1. Glass Type GL-2 plus airspace and composite metal backpan at back edge of mullions (provided by curtainwall supplier)
 2. Refer to Drawings for limits of frit pattern within individual glazed units.
- H. Type GL-6 (Insulated Laminated Silkscreen Vision Glass Units) for skylight: Total unit thickness 1 5/16" inch.
1. Insulated Laminated Silkscreen Argon Filled: ASTM E2190; with edge seal; purge interpane space with Argon. All glass to be clear low iron.
 - a. Makeup:
 - 1) 1/4" Patterned Tempered Glass with patterned frit on #2 surface.
 - 2) 1/2" Argon-filled space.
 - 3) 1/4" Clear Heat Strengthened Glass
 - 4) 1/16" (nom) Lamination Layer
 - 5) 1/4" Clear Heat Strengthened Glass
 2. Frit pattern: Viracon #5006 #2 (40% dot coverage).
 3. Ceramic Frit Color: Viraspan V175 – High Opacity White
 4. Insulated Glass Unit Edge Seal Construction: As recommended by the manufacturer to meet the specified warranty.
- I. Type GL-7 (Monolithic Vision Glass Units) for interior applications: 1/4 inch thick clear low iron glass.
1. Provide tempered glass within and adjacent to doors.
- J. Type GL-8 (Monolithic Laminated Vision Glass Units) for interior office applications: 1/4 inch thick.
1. Clear laminated low iron glass constructed with two plies of 1/8" float glass and one ply of Saflex "Cool White" .030" pvb interlayer with 81% visible light transmittance.
- K. Type GL-9 (Monolithic Vision Glass Units) for atrium north and south walls: 3/8 inch thick clear tempered low iron glass.
- L. Type GL-10 (Laminated Silkscreen Vision Glass Units) for guardrails: 1/2 inch thick.
1. Clear laminated low iron glass constructed with two plies (clear inboard) of 1/4" float glass and one ply of clear .030" pvb interlayer with patterned frit on #2 surface.

2. Frit pattern: Frit pattern: Viracon #5960 #2.
 3. Ceramic Frit Color: Viraspan V175 – High Opacity White.
 4. Coordinate drilling of glass for rail connections with rail fabricator.
- M. Type GL-11 Aluminum Entrance Doors (included in Section 08 4113): 3/8 inch thick clear tempered low iron glass, or Laminated glass constructed with two plies (clear inboard) of 1/4" float glass and one ply of clear .030" pvb interlayer.

END OF SECTION

SECTION 08 8300

MIRRORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glass mirrors for frameless installation.
 - 2. Mirrors for installation into sections referencing this section for products and installation.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 07 9000 - Joint Protection: Sealant and back-up material.
 - 3. Section 08 8000 - Glazing: Glass and glazing.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.
- B. ASTM International:
 - 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM C1036 - Standard Specification for Flat Glass.
 - 3. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- C. Glass Association of North America:
 - 1. GANA - FGMA Sealant Manual.
 - 2. GANA - Glazing Manual.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 - 1. Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Manufacturer's Certificate: Certify mirrors meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.

1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for mirror installation methods.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install glazing when ambient temperature is less than 50 degrees F.
- C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing sealants.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Mirror Glass (Type MR-I): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q1 mirror select; type with copper and silver coating, and organic overcoating.
1. Edges: Polished.

2. Thickness: Minimum 1/4 inch unless otherwise indicated.
3. Size: Noted on Drawings.
4. Mirrors to be adhered to backer board and mounted with Z clips to walls. Refer to Drawings for details.

2.2 ACCESSORIES

- A. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.
- B. Mirror Adhesive: Chemically compatible with mirror coating and mirror backer board.
- C. Mirror Backer Board: Wood Particleboard: ANSI A208.1 Type 1; composed of wood chips or sawdust, medium density, made with high waterproof resin binders; sanded faces and prime painted on both faces. Secure backer board to walls with Z clips.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify locations for mirrored glazing are correctly sized and within tolerance.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

3.3 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
 1. Glazing Sealants: Comply with ASTM C1193.
 2. Set mirrors plumb and level, free of optical distortion.
 3. Set mirrors with edge clearance free of surrounding construction including counter tops and backsplashes.
- B. Frameless Mechanical Installation:
 1. Adhere mirrors to backer panels. Anchor rigidly to wall construction.
 2. Place plumb and level without visible distort.

3.4 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove labels after Work is complete.
- C. Clean mirrors and adjacent surfaces.

END OF SECTION

LOUVERS

SECTION 08 9100

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Fixed louvers, frames, invisible mullions and accessories .
 - 2. Custom aluminum trim for extended sill, head and jambs.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 07 9000 - Joint Protection: Sealant at louver perimeter.
 - 3. Division 23 - HVAC Ducts and Casings: Ductwork attachment to louver.
 - 4. Division 26 - Equipment Wiring Connections: Electrical characteristics and wiring connections to louver operator.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500- L - Test Methods for Louvers, Dampers, and Shutters.
 - 2. AMCA 511 – Certified Ratings Program for Air Control Devices.

- B. ASTM International:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

- C. Underwriters Laboratories Inc.:
 - 1. UL - Electrical Construction Equipment Directory.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames [and wiring diagrams].

- C. Product Data: Submit data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

- D. Samples: Submit two 2 x 2 inch in size illustrating finish and color of exterior surfaces.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS:

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials : For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants : Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA Certification for Water Penetration, Air Performance, and Wind Driven Rain, in compliance with AMCA 500-L. Attach AMCA seal to louvers.

1.7 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:**
 - 1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.
- B. **Production Qualifications:**
 - 1. Louvers shall be licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. **Delivery:** Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- B. **Storage:** Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. **Handling:** Protect materials and finishes during handling and installation to prevent damage
- D. **Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.**

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. **Field Measurements:** Verify actual dimensions of openings by field measurements before fabrication. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.10 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with installation of masonry flashings.
- C. Coordinate Work with installation of mechanical ductwork.

1.11 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.

- B. Manufacturer shall provide 20 year limited warranty for fluoropolymer-based finish on aluminum substrates.
 - 1. Finish Coating shall not peel, blister, chip, crack, or check.
 - 2. Chalking, fading, or erosion of finish when measured by the following tests:
 - a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
 - b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822
 - c. Finish coating shall not erode at a rate in excess of .01 mils/year confirmed by Florida test samples.

PART 2 PRODUCTS

2.1 WALL LOUVERS - DRAINABLE STYLE

- A. Acceptable Manufacturers:
 - 1. Airline Products Co.
 - 2. Cesco Products.
 - 3. Construction Specialties Inc..
 - 4. Greenheck Corp.
 - 5. Industrial Louvers Inc.
 - 6. American Warming & Ventilating.
 - 7. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Louver Construction: Extruded aluminum frame and blades shall be designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and of channels in jambs.
 - 1. Basis of Design: Industrial Louver Model 653XP.
 - a. Louvers shall permit a minimum of 50% free area.
 - 2. Frame:
 - a. Frame Depth: 6 inches.
 - b. Material: Extruded aluminum, 6063-T6
 - c. Wall Thickness: 0.081 inch (2.1 mm), nominal.
 - d. Sill and jamb frames shall be continuously welded and caulked to prevent water penetration to interior wall construction. Blades are attached by means of all-welded construction.
 - 3. Blades:
 - a. Style: Drainable with gutters in front edges of blades and channels in jambs,
 - b. Material: Extruded aluminum, 6063-T6
 - c. Wall Thickness: 0.081 inch (2.1 mm), nominal
 - d. Angle: 37.5 degrees
 - e. Centers: 4.25 inches (108 mm), nominal.
- C. Louver: To permit passage of intake air at a velocity of 500 ft / min without blade vibration or noise.
- D. Water Penetration: Not more than 0.01 oz/sq ft of free area at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.

2.2 COMPONENTS

- A. Aluminum Sheet: ASTM B209 Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to provide required finish.
- B. Fastenings: Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.
- C. Bird Screen: Removable extruded aluminum frame with interwoven wire mesh of aluminum, 0.063 inch diameter wire, 1/2 inch open weave, square design.
- D. Blank Off Panels
 - 1. Insulated Blank Off Panels factory installed with removable screws and foam tape gaskets:
 - a. 1 inch thick and to be faced on both sides with 0.032 inch thick aluminum sheet. Panels to be fabricated with rigid fiberboard core having an R-Value of 4. Panel perimeter frame to be a 0.063 inch thick extruded aluminum Z shape. Panels to be finished to match louvers on one side only.

2.3 ACCESSORIES

- A. Exterior Aluminum Sill: Provide custom aluminum extended sill in profile as indicated on Drawings.
 - 1. Material: 1/8 inch thick aluminum plate formed to profile indicated.
 - 2. Finish shall match louvers.
- B. Exterior Aluminum Jamb and Head Trim: Provide custom aluminum trim in profile indicated on Drawings.
 - 1. Material: 1/8 inch thick aluminum plate formed to profile indicated.
 - 2. Secure to louver frame with concealed fasteners.
 - 3. Finish shall match louvers.
- C. Primer: Zinc chromate, alkyd type.
- D. Flashings: Of same material as louver frame.
- E. Sealants: As specified in Section 07 9000.

2.4 FABRICATION

- A. Performance: Fabricate as required for optimum performance with respect to water penetration, strength, durability, and appearance.
- B. Size: Fabricate louvers in walls to meet dimensions indicated on Contract Documents.
- C. Field Measurement: Verify size, location, and placement of louvers before fabrication.
- D. Shop Assembly:

1. Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.
 2. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.
 3. Clearly mark units for reassemble and coordinated installation.
- E. Accessories: Include supports, anchorages and accessories required for complete assembly.
- F. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.
- G. Connections: Join frame and blade members to one another by mechanical fastener, except where field bolted connections between frame members are made necessary by size of louvers.
- H. Spacing: Maintain equal blade spacing to produce uniform appearance.

2.5 FACTORY FINISHING

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process.
- B. Exterior Aluminum Surfaces, Screen and Blank-Out Sheeting: Clean and prime exposed aluminum surfaces and apply a fluoropolymer coating system.
- C. High Performance Organic Coating: Fluoropolymer coating system complying with AAMA 2604 or 2605, two coat system, with minimum 70 percent polyvinylidene fluoride resin.
1. Color: PPG Duranar Sunstorm UC106686F, "Cosmic Gray".
- D. Interior Aluminum Surfaces Screens and Blank-Out Sheeting: To match exterior surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify prepared openings and flashings are ready to receive Work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Install louvers level and plumb.

- B. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- C. Secure louvers in opening framing with concealed fasteners,
- D. Install bird screen and frame to interior of louver.
- E. Install perimeter sealant and backing rod in accordance with Section 07 9000.

3.3 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.4 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements - Final cleaning.
- B. Strip protective finish coverings.
- C. Clean surfaces and components.

END OF SECTION

SECTION 09 0502

FINISH MATERIAL LEGEND

GENERAL

1.1 INTERIOR MATERIALS

- A. WD-1 (Wood): White Oak, quarter sawn with clear, transparent finish.
- B. RB-1 (Rubber Base): Color: Black
- C. RB-2 (Rubber Base): Integral cove base. Color: Dark Grey To match RBS-1.
- D. RBS-1 (Rubber Sheet Flooring): Mondo, Harmoni HAS73. Color: Dark Grey
- E. RBT-1 (Rubber Tile Flooring): Mondo, Harmoni HAS73, Color: Dark Grey
- F. SDRT-1 (Static-Dissipative Resilient Tile): Roppe Rubber Tile. Color: F410, Marengo.
- G. EF-1 (Epoxy Flooring): Dur-A-Gard ESD. Color: Slate Grey.
- H. CPT-1 (Carpet Tile): InterfaceFLOR, Style: 'Blended', monolithic installation. Color #100219.
- I. CPT-2 (Carpet Tile): InterfaceFLOR, Style: 'Grooved', monolithic installation. Color #100089.
- J. AGC-1 (Acoustic Gypsum Ceiling): Danoline "Belgravia", perforated gypsum panels (refer specification Section 09 5113).
- K. ACT-1 (Acoustic Ceiling Tile): Armstrong Ultima Tegular 24"x24" ceiling tile, with Suprafine 9/16" grid and Armstrong Axiom Classic 6" Trim Channel at ceiling clouds
- L. PT-1 (Paint): ICI, White High-Hiding RM, #A0113
- M. PT-2 (Paint): ICI, Silver Clamshell, #623.
- N. PT-3 (Paint): ICI, Balkan Sea, #A1363
- O. PT-4 (Paint): PPG Duranar XL #UC51131XL, Silver.
- P. PT-5 (Paint): TBD.
- Q. PT-6 (Paint): ICI, Dark Secret, #A2016.
- R. PT-7 (Paint): TBD.
- S. PT-8 (Paint): TBD.
- T. SSM-1 (Solid Surface Material): Richlite. Color: Black Diamond.

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- U. SSM-2 (Solid Surface Material): Cambria. Color: Snowdon White.
 - V. SSM-3 (Solid Surface Material - restrooms only): Cambria. Color: Cardiff Cream.
 - W. T-1 (Floor Tile): Crossville, "Color Blox Too", size 12"x12", in Unpolished Cross-Sheen (UPS) finish. Color: A1123, Hi Ho Silver.
 - X. T-2 (Wall Tile): Crossville, "Color by Numbers", size 4"x 8", in Gloss finish. Color: WT03. Three Hour Tour.
 - Y. T-3 (Wall Accent Tile): Crossville, style: "Color by Numbers", size 4"x 8", in Gloss finish. Color: WT10, A Perfect Ten.
 - Z. PL-1 (Plastic Laminate): Formica #5283-58 Dogbone Storm.
 - AA. PL-2 (Plastic Laminate): Formica #5281-58 Dogbone White.

END OF SECTION

SECTION 09 2116

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
1. Metal stud wall framing.
 2. Metal channel ceiling framing.
 3. Shaft wall system.
 4. Gypsum board and joint treatment (GWB-1).
 5. Acoustic perforated gypsum board (GWB-2)
 6. Sound attenuation batt insulation.
 7. Abuse-resistant gypsum panels (GWB-3)
 8. Noise reducing gypsum panels (GWB-4)
 9. Tile backing board.
 10. Sheet metal backing plate.
- B. Related Sections:
1. Section 01 8113 – Sustainable Design Requirements.
 2. Section 05 4000 - Cold-Formed Metal Framing: Exterior sheathing.
 3. Section 06 1052 – Miscellaneous Rough Carpentry: Wood blocking.
 4. Section 07 2116 - Blanket Insulation: Acoustic and thermal insulation.
 5. Section 08 3113 - Access Doors and Frames: Metal access panels.
 6. Section 09 5113 - Acoustical Ceilings: Acoustic Gypsum Panels and Suspension Systems.
 7. Section 09 9000 - Painting.

1.2 REFERENCES

- A. ASTM International:
1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 2. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
 3. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
 5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 6. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 7. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
 8. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

9. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
 10. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
 11. ASTM C1178 - Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
 12. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
 13. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
 14. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 15. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 16. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. Gypsum Association:
1. GA 214 - Recommended Levels of Gypsum Board Finish.
 2. GA 216 - Application and Finishing of Gypsum Board.
 3. GA 600 - Fire Resistance Design Manual Sound Control.
- C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.
- D. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- E. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

- A. Design and install framing and furring to limit deflection to the following under point loads of 100 lbs and uniform loads as noted below psf except where required by to withstand greater load. (pressurized shafts for example)
1. Maximum Deflection of Vertical Assemblies: Sustained loads of 7.5 lbf/sq ft with a maximum mid span deflection of 1:240.
 2. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.
 3. Maximum Deflection for Plaster (Portland Cement or Gypsum) and ceramic tile is 1:360.
 4. Provide movement connections per Section 05 40 00
 5. Use The SSMA Product Technical Information Book to look up the appropriate stud size, spacing and thickness.
- B. Acoustic Attenuation for Interior Partitions: STC's are calculated in accordance with ASTM E 413 and based on published tests conducted in accordance with ASTM E 90.
1. Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90. See Drawings for STC requirements.

- C. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on metal framing, gypsum board, joint tape and acoustic accessories.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
 - 1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840. ASTM C1280. GA-214, and GA-216 and GA-600.
- B. Fire Rated Wall, Floor, Roof Construction: Ratings as indicated on Drawings.
 - 1. Assembly Tested Rating: Determined in accordance with ASTM E119.

- C. Surface Burning Characteristics:
 - 1. Textile Wall Coverings: Comply with one of the following:
 - a. Maximum 25/450-flame spread/smoke developed index when tested in accordance with ASTM E84.
 - b. Comply with requirements of applicable code when tested in accordance with NFPA 265 Method A or Method B test protocols.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years of experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Acceptable Manufacturers:
 - 1. CertainTeed Corporation.
 - 2. Clark Dietrich Building Systems.
 - 3. Dale / Incor.
 - 4. G-P Gypsum Corp.
 - 5. National Gypsum Co.
 - 6. Serious Energy (QuietRock)
 - 7. United States Gypsum Co (USG).
 - 8. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 METAL FRAMING

- A. Metal Studs: Non-load bearing rolled steel, minimum G40 galvanized steel, channel shaped, minimum 20 gauge. Increase stud gauge as required, according to manufacturer's standards, to achieve a maximum allowable deflection of L/240 for typical interior partition types. Studs shall be punched for utility access.
 - 1. Provide studs to achieve a maximum allowable deflection of L/360 at walls to receive plaster finish, cement backer board, and water resistant gypsum board with ceramic tile facing.
- B. Track: Provide minimum 1 1/4 inch high legs.
 - 1. Minimum same gauge material gauge as studs.
 - 2. Bent leg retainer notched to receive studs with provision for crimp locking to stud.

- C. Shaft Wall Studs and Accessories: Equivalent to USG "C-H" galvanized steel studs.
 - 1. Size studs according to specified performance requirements and as noted on drawings.
 - 2. Provide related perimeter framing members including J-runners, E-studs and jamb struts as required.
- D. Floor and Ceiling Runners: L shaped, 20 gauge galvanized steel, 2" x 2" size, unless otherwise indicated.
- E. Furring and Bracing Members: 25 gage, galvanized steel hat-shaped or z-shaped, plain or knurled face.
- F. Sheet Metal Backing Plate: Flat stock galvanized steel, for support of crash rails, corner guards, shelves, cabinets, accessories and equipment in laboratories, offices, and service areas.
 - 1. Size: 8 inch minimum height.
 - 2. Gauge: 20 GA.
 - 3. Wood blocking shall be provided at handrails and grab bars. Refer to Section 06 1053.
- G. Fasteners: As recommended by metal framing system manufacturer.
- H. Channels and Hanger Wire: GA 216.
- I. Fasteners and Anchorages: GA 216; length to suit application.

2.3 GYPSUM BOARD MATERIALS

- A. Provide gypsum board materials in accordance with recommendations of GA 216 and ASTM C1396/C1396M; Type X fire resistant where indicated on Drawings.
 - 1. Recycled Content Requirements: Minimum 5 percent post-consumer recycled content, or minimum 20 percent pre-consumer recycled content at contractor's option.
- B. Standard Gypsum Board: 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.
- C. Standard Fire Rated Gypsum Board: 5/8 inch thick - Type X; maximum permissible length; ends square cut, tapered edges.
- D. Moisture and Mold Resistant Gypsum Board: 1/2 or 5/8 inch thick; maximum permissible length; tapered edges with square cut ends.
 - 1. Provide paperless water-resistant gypsum board with a water-resistant core, complying with ASTM C 1177; Provide G-P Gypsum, "Dens Armor Plus Paperless Gypsum Board" or equivalent.
 - 2. Mold Resistance: Score of 10 when tested in accordance with ASTM D3273.
- E. Abuse-Resistant Gypsum Panels (GWB-3): 5/8" thick, maximum permissible length; ends square cut, edges tapered. Provide USG "Fiberock" abuse-resistant gypsum panels, or approved equal. Refer to Drawings for locations.

- F. Noise-Reducing Gypsum Panels (GWB-4): 5/8" thick, maximum permissible length; ends square cut; tapered edges. Provide Certainteed "SilentFX", QuietRock, or equivalent product by acceptable manufacturers.
- G. Gypsum Shaft liner: ASTM C442, 1 inch thick, maximum available size in place; double bevel long edges, with ends square cut.
- H. Tile Backing Boards:
 - 1. Cementitious Backing Board: 1/2 or 5/8 inch thick; aggregated Portland cement board with woven glass fiber mesh facing; complying with ANSI A118.9.
 - a. Provide Durock Cement Board by U.S. Gypsum Co., with coated glass fiber tape for joints and corners.
 - 2. Mold Resistance: Score of 10 when tested in accordance with ASTM D3273.
 - 3. Size: 48" wide by length of 8'-0".

2.4 ACOUSTICAL PERFORATED GYPSUM FOR WALLS AND MONOLITHIC CEILINGS (GWB-2).

- A. Basis of Design: Danoline; Solopanel.
 - 1. Perforation Pattern: G15 / 30.
 - 2. Thickness: 1/2 inch.
 - 3. Size: Provide panel sizes to most economically cover wall and ceiling area indicated on Drawings.
 - 4. Acoustic insulation: Absorbent black felt backing with integral 3/4 inch mineral fiber acoustic batt.
 - 5. Accessories: Provide for complete installation of system.
- B. Substitutions: Under provisions of Section 01 1600. Provide comparable product by one of the following:
 - 1. Armstrong World Industries, Inc .
 - 2. United States Gypsum Co (USG).

2.5 ACCESSORIES

- A. Sound Attenuation Batt Insulation: ASTM C665, Type 1; preformed glass fiber batt; friction fit, conforming to the following:
 - 1. Facing: Unfaced.
 - 2. Thickness: 3 1/2 inches unless otherwise noted on Drawings.
 - 3. Width: 16" to friction fit between in metal stud wall cavities.
- B. Acoustic Sealant: As specified in Section 07 9000.
- C. Gypsum Board Accessories: ASTM C1047; metal; corner beads, edge trim, and expansion joints.
 - 1. Metal Accessories: Galvanized steel or rolled zinc.
 - 2. Edge Trim: Type L bead.
 - 3. Control Joint.
- D. Reveals and Other Specialty Trim:
 - 1. Reveal Molding: Fry Reglet Reveal Molding, DRM-625-25 (5/8" deep, 1/4" wide). Locations as indicated on Drawings.

- E. Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, and water.
- F. Gypsum Board Screws: ASTM C954; length to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Metal Stud Installation:
 - 1. Install studs in accordance with ASTM C754.
 - 2. Metal Stud Spacing: Maximum 16 inches on center.
- B. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- C. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- D. Blocking: Bolt or screw steel channels to studs. Install steel sheeting for blocking support of wall shelves, cabinets, and equipment.
- E. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- F. Wall Furring Installation:
 - 1. Erect wall furring directly attached to concrete block and concrete walls.
 - 2. Space furring channels maximum 16 inches on center for 1/2 inch gypsum board, 24 inches on center for 5/8 inch gypsum board, not more than 4 inches from floor and ceiling lines.
 - 3. Erect metal stud framing adjacent to concrete or concrete masonry walls as indicated on Drawings; attach by adjustable furring brackets.
 - 4. Furring For Fire Ratings: Install furring as required for fire resistance ratings indicated and to GA-600 requirements.
- G. Shaft Wall Framing: Install in accordance with GA-600 requirements.
- H. Ceiling Framing Installation:
 - 1. Install in accordance with ASTM C754.
 - 2. Coordinate location of hangers with other work.
 - 3. Install ceiling framing independent of walls, columns, and above ceiling work.

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4. Reinforce openings in ceiling suspension system that interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
 5. Laterally brace entire suspension system.
- I. Acoustic Accessories Installation:
1. Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
 2. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
 3. Install acoustic sealant at gypsum board perimeter at:
 - a. Metal Framing: Set tracks in two beads of sealant.
 - b. Gypsum Board Base Layer.
 - c. Seal penetrations of partitions by conduit, pipe, ductwork, and rough-in boxes,
- J. Gypsum Board Installation:
1. Install gypsum board in accordance with ASTM C840, and GA-216
 2. Erect single layer standard gypsum board in direction most practical and economical, with ends and edges occurring over firm bearing.
 3. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
 4. Use screws when fastening gypsum board to metal furring or framing.
 5. For double layer applications, use gypsum board for first layer. Use fire rated gypsum board for fire rated partitions. Place second layer perpendicular to first layer. Ensure joints of second layer do not occur over joints of first layer.
 6. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
 7. Treat cut edges and holes in moisture resistant gypsum board with sealant.
 8. Place corner beads at external corners. Use longest practical lengths. Place edge trim where gypsum board abuts dissimilar materials.
 9. Install cementitious backing board over metal studs.
 10. Apply gypsum board to curved walls in accordance with GA-216.
 11. Provide moisture resistant gypsum board on all gypsum surfaces exposed to view (walls and ceilings) in which major plumbing and/or wet activities occur (toilet rooms, kitchens, etc).
 12. Install tile backer board in lieu of gypsum board as substrate for all ceramic wall tile applications; install per manufacturer's instructions.
- K. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.
- L. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
- M. Fill and finish joints and corners of cementitious backing board.

3.3 CONTROL JOINTS

- A. Place control joints in long expanses of partitions as shown on the Drawings, or at 30-foot intervals where not indicated, in locations consistent with lines of building spaces. Review layouts with Architect prior to installation.
- B. Provide control joints at one side of door jambs, typical, extending from door head to ceiling.
- C. Finish joints in accordance with GA-214.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

3.5 PROTECTION

- A. Protect installed products from damage during remainder of the construction period.
- B. Remove and replace panels that are damaged.

3.6 SCHEDULES

- A. Finishes in accordance with GA-214 Level:
 - 1. Level 1: Above finished ceilings and concealed from view.
 - 2. Level 2: Utility areas and areas behind cabinetry.
 - 3. Level 3: NOT USED
 - 4. Level 4: Walls, columns and ceilings scheduled to receive flat or eggshell paint finish.
 - 5. Level 5: Walls, columns and ceilings scheduled to receive semi-gloss or gloss paint finish
 - 6. Level 5: Provide at all locations of Impact resistant gypsum board.

END OF SECTION

SECTION 09 3000

TILE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes;
 - 1. Ceramic tile for floor and wall applications.
 - 2. Thresholds at door openings.
 - 3. Tile edging and transition strips at tile edges.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 - Concrete Finishing: Troweling of floor slab for tile application.
 - 3. Section 07 9000 - Joint Protection.
 - 4. Section 09 0502 – Finish Material Legend: Product Selections.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A108.1 - Installation of Ceramic Tile, A collection.
 - 2. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
 - 3. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
 - 4. ANSI A108.1B - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
 - 5. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
 - 6. ANSI A108.4 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
 - 7. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
 - 8. ANSI A108.6 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy.
 - 9. ANSI A108.7 - Specifications for Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar.
 - 10. ANSI A108.8 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
 - 11. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
 - 12. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
 - 13. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
 - 14. ANSI A118.4 - Latex-Portland Cement Mortar.
 - 15. ANSI A118.5 - Chemical-Resistant Furan Mortar and Grout.

16. ANSI A118.6 - Ceramic Tile Grouts.
 17. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
 18. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units.
 19. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
 20. ANSI A137.1 - Ceramic Tile.
- B. ASTM International:
1. ASTM C847 - Standard Specification for Metal Lath.
- C. Tile Council of America:
1. TCA - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate tile layout, patterns, perimeter conditions, junctions with dissimilar materials, control and expansion joints, trim and setting details.
- C. Product Data: Submit instructions for using grouts and adhesives.
- D. Samples: Submit three tile samples for each type, and color variation. Submit three grout samples for each type, and color variation.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Materials Reuse : For materials that will be salvaged or refurbished.
1. Provide receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
- B. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- C. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.

4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- D. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with TCA Handbook and ANSI A108 Series/A118 Series.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Protect adhesives and grouts from freezing or overheating.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install adhesives and grouts in unventilated environment.
- C. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.10 EXTRA MATERIALS

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply 20 sq ft of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.1 TILE

- A. Acceptable Manufacturers:
 - 1. Crossville Ceramics Co.
- B. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Porcelain Floor Tile (T-1): ANSI A137.1, conforming to the following:
 - 1. Moisture Absorption: 0 to 0.5 percent.
 - 2. Size: Refer to Section 09 0502.
 - 3. Shape: Square.
 - 4. Edge: Cushioned.
 - 5. Surface Finish: Unpolished.
 - 6. Color: Refer to Section 09 0502
- B. Glazed Ceramic Wall Tile (T-2): ANSI A137.1, conforming to the following:
 - 1. Size: Refer to Section 09 0502.
 - 2. Shape: Rectangular.
 - 3. Edge: Lugged perimeter.
 - 4. Surface Finish: Gloss.
 - 5. Color: Refer to Section 09 0502
- C. Glazed Ceramic Wall Tile (T-3): ANSI A137.1, conforming to the following:
 - 1. Size: Refer to Section 09 0502.
 - 2. Shape: Rectangular coved.
 - 3. Edge: Lugged perimeter.
 - 4. Surface Finish: Gloss.
 - 5. Color: Refer to Section 09 0502
- D. Porcelain Wall Base (T-2): Coved base.

2.3 WATERPROOFING MEMBRANE FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10.
- B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement.
- C. Products:
 - 1. Custom Building Products; Trowel & Seal Waterproofing and Anti-Fracture Membrane.
 - 2. Laticrete International Inc.; Laticrete 9235 Waterproof Membrane.
 - 3. Mapei Corporation; PRP M19.
 - 4. Substitutions: Submit under provisions of Section 01 6000.

2.4 ACCESSORIES

- A. Adhesive Materials:
 - 1. Organic Adhesive: ANSI A136.1, thin-set bond type.
 - 2. Tile Setting Adhesive: Elastomeric, waterproof, liquid applied.
- B. Mortar Materials:
 - 1. Mortar Bed Materials: Portland cement, sand, latex additive, and water.
 - 2. Mortar Bond Coat Materials:
 - a. Latex-Portland Cement type: ANSI A118.4.
- C. Grout Materials:
 - 1. Grout: ANSI A118.7, polymer modified tile grout; sanded for floor applications and unsanded for walls applications.
 - a. Grout Color 1: To be determined. For use with T-1.
 - a. Grout Color 2: To be determined. For use with T-2 and T-31.
- D. Tile Transition Strips and Trim:
 - 1. Floor Transition between Tile and Concrete: Schluter Schiene-E.
 - a. L-shaped profile with 1/8 inch (3.2 mm) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - b. Material and Finish: Brushed Stainless Steel, Type 304.
 - c. Height: As required to suit application.
 - 2. Outside Wall Corner: Schluter Quadec-EB.
 - a. Profile with square visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - b. Material and Finish: Brushed Stainless Steel, Type 304.
 - c. Height: As required to match tile.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces are ready to receive work.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean. Seal substrate surface cracks with filler.

3.3 INSTALLATION

- A. Install tile, thresholds and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook recommendations.
- B. Tile Installation - Floors - Thin-Set Methods:

1. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
 - a. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.
- C. Waterproofing Membrane Installation
 1. 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.
 2. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- D. Tile Installation – Typical Walls:
 1. Over interior concrete and masonry substrates install in accordance with TCA Handbook Method W202, thin-set method with dry-set or latex-portland cement bond coat.
- E. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- F. Place edge strips at locations indicated on Drawings.
- G. 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.
- H. 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.
- I. Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
 1. Porcelain Floor Tile: 1/4 inch.
 2. Ceramic Wall Tile: 1/16 inch.
- J. Form internal angles square. Install corner trim at outside corners and abut tile into them.
- K. Sound tile after setting. Replace hollow sounding units.
- L. Keep expansion / control joints free of adhesive or grout. Apply sealant to joints.
- M. Allow tile to set for a minimum of 48 hours prior to grouting.
- N. Grout tile joints. Use standard grout unless otherwise indicated.
- O. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 CLEANING AND PROTECTION

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning and protecting installed construction.
- B. Clean tile and grout surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit traffic over finished floor surface for a minimum of 4 days after installation.

END OF SECTION

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Suspended metal grid ceiling systems.
 - 2. Acoustical panel units (ACT-1).
 - 3. Acoustical gypsum panels (AGC-1).

- B. Related Sections:
 - 1. Section 01 2300 – Alternates: Metal ceiling panel system.
 - 2. Section 01 8113 – Sustainable Design Requirements.
 - 3. Section 07 2116 - Blanket Insulation.
 - 4. Section 07 9000 - Joint Protection.
 - 5. Section 08 3113 - Access Doors and Frames: Access panels.
 - 6. Section 09 2116 – Gypsum Board Assemblies: Acoustical gypsum board.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 3. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 5. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 6. ASTM E580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
 - 7. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

- B. Ceilings and Interior Systems Construction Association:
 - 1. CISCA - Acoustical Ceilings: Use and Practice.

- C. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

- D. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 - 2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

- E. Underwriters Laboratories Inc.:
 - 1. UL - Fire Resistance Directory.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

- A. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1: 360.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on metal grid system components and acoustic units.
- C. Samples: Submit three samples minimum, 6 x 6 inches in size illustrating material and finish of each type of acoustic units.
- D. Samples: Submit two samples each, 12 inches long, of suspension system main runner, and perimeter wall molding.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post-consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

1.6 QUALITY ASSURANCE

- A. Conform to CISCA requirements.
- B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum three years' experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Maintain uniform temperatures of minimum 55 degrees F and relative humidity of 30 percent to 60 percent prior to, during and after installation.

1.10 SEQUENCING

- A. Section 01 1000 - Summary: Requirements for sequencing.
- B. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- C. Install acoustic units after interior wet work is dry.

1.11 EXTRA MATERIALS

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish 1 percent of total acoustic unit area of extra panels to Owner.

PART 2 PRODUCTS

2.1 SUSPENDED ACOUSTICAL CEILINGS

- A. Acceptable Manufacturers:
 - 1. Armstrong World Industries.
 - 2. CertainTeed Ceilings.
 - 3. USG Interiors.
 - 4. Substitutions: Under provision of Section 01 6000 - Product Requirements.

2.2 ACOUSTIC UNIT MATERIALS

- A. Acoustic Tile – Type 1: ASTM E1264, conforming to the following:
 - 1. Style: Refer to Section 09 0502.
 - 2. Thickness: 3/4 inches.
 - 3. Edge: Tegular.
 - 4. Surface Color: White.
 - 5. Use with Grid Type A.

2.3 SUSPENSION GRID MATERIALS

- A. Grid Type A (Exposed): Non-fire Rated Grid: ASTM C635, heavy duty; exposed T; components die cut and interlocking.
 - 1. Exposed Grid Surface Width: 9/16 inch.
 - 2. Grid Finish: White.
- B. Grid Type B (Exposed): Non-fire Rated Grid: ASTM C635, heavy duty; exposed T; components die cut and interlocking.
 - 1. Exposed Grid Surface Width: 15/16 inch.
 - 2. Grid Finish: White.
- C. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- D. Accessories: Stabilizer bars and furring clips; hold down clips and shadow line edge moldings as required to complete and complement suspended ceiling grid system.
- E. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- F. Hangar Wire: 12 gauge galvanized annealed steel wire.

2.4 ACOUSTICAL GYPSUM PANELS (AGC-1)

- A. Basis of Design: Danoline; Belgravia.
 - 1. Perforation Pattern: Globe - G1.
 - 2. Size: 610 x 610 x 12.5 mm panel size.
 - 3. Perforation %: 10.2 % with 37.5mm wide solid border perimeter on all sides.
 - 4. Edge Detail: Tegular.
 - 5. Finish: White painted
 - 6. Acoustic insulation: Absorbent felt backing and 3/4 inch mineral fiber acoustic batt.
 - 7. Grid: Type B.
 - 8. Perimeter Trim: Perimeter trim channel.
- B. Substitutions: Under provisions of Section 01 1600 – Product Requirements. Provide comparable product by one of the following:
 - 1. Armstrong World Industries, Inc (www.ceilings.com):
 - 2. USG: www.usg.com.

2.5 PERIMETER TRIM CHANNEL

- A. Basis of Design: Armstrong, “Axiom Classic Trim”.
 - 1. Size: Nominal 6” wide face with 3/4” horizontal legs; straight sections.
 - 2. Commercial quality extruded aluminum alloy 6063 Trim Channel and Bottom Drywall Trim, factory-finished in factory-applied baked polyester paint finish in manufacturer’s standard color.
 - 3. Corners: Factory-mitered corners with field assembly; 12” x 3/4” x 12” outside / inside corners.
 - 4. Accessories: Aluminum T-Bar connection clip and hanging clip. Galvanized steel splice plates as needed to complete the work.

- B. Substitutions: Under provisions of Section 01 1600 – Product Requirements. Provide comparable product by one of the following:
 - 1. CertainTeed Ceilings.
 - 2. USG Interiors.

2.6 ACCESSORIES

- A. Acoustic Batt Insulation: Unfaced; 3 1/2 inch thick. Refer to Section 07 2116 for specification.
- B. Gypsum Board: Fire rated type. Refer to Section 09 2116 for specification.
- C. Acoustic Sealant For Perimeter Moldings. Refer to Section 07 9000 for specification.
- D. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.
- E. Touch-up Paint: Type, sheen and color to match acoustic and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify layout of hangers will not interfere with other work.

3.2 INSTALLATION

- A. Lay-In Grid and concealed Suspension System:
 - 1. Install suspension system in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
 - 2. Install ceiling systems in a manner capable of supporting all imposed loads, with maximum permissible deflection of 1/360 of span.
 - 3. Locate system on room axis according to reflected ceiling plans.
 - 4. Install after major above ceiling work is complete. Coordinate location of hangers with other work. Ensure the layout of hangers and carrying channels are located to accommodate fittings and units of equipment that are to be placed after the installation of ceiling grid system.
 - 5. Install hanger clips during steel deck erection. Install additional hangers and inserts as required.
 - 6. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
 - 7. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
 - 8. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
 - 9. Do not eccentrically load system, or produce rotation of runners.

10. Perimeter Edge Molding:
 - a. Install edge molding at intersection of ceiling and vertical surfaces into bed of acoustic sealant or provide with continuous gasket.
 - b. Use longest practical lengths.
 - c. Miter corners.
 - d. Install at junctions with other interruptions.
 11. Perimeter Trim Channel:
 - a. Install trim channel according to manufacturer's recommendations.
 - b. Locate at perimeter of ceiling areas, as indicated on Drawings..
 - c. Use longest practical lengths.
 - d. Provide factory mitered corners.
 - e. Install at junctions with other interruptions.
 12. Form expansion joints as detailed on Drawings. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
- B. Acoustic Units:
1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
 2. Lay directional patterned units one way with pattern parallel to shortest room axis. Fit border trim neatly against abutting surfaces.
 3. Install units after above ceiling work is complete.
 4. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
 5. Cutting Acoustic Units:
 - a. Cut to fit irregular grid and perimeter edge trim.
 - b. Double cut and field paint exposed edges of tegular units.
 6. Where round obstructions occur, install preformed closures to match perimeter molding.
- C. Install one layer of sound attenuation insulation above ceiling extending out 48 inches perpendicular to each side of partitions where indicated. Butt pieces of insulation together.

3.3 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6413

WOOD FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes prefinished, tongue and groove wood plank flooring, back screwed; with underlayment, secondary subflooring, and surface finishing.
 - 1. For application at Stair 3. Refer to Drawings for additional information.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 7000 – Decorative Metal Fabrications: Stair 3 metal components.
 - 3. Section 06 2000 – Finish Carpentry: Related wood components.

1.2 REFERENCES

- A. APA-The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- B. ASTM International:
 - 1. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- C. National Fire Protection Association:
 - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- D. National Oak Flooring Manufacturers Association:
 - 1. NOFMA 24 - Installing Hardwood Flooring - Strip, Plank & Parquet.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate wood floor pattern and termination details.
- C. Product Data: Submit data for flooring and floor finish materials.
- D. Samples: Submit three samples 4 x12 inch in size illustrating floor finish, typical wood pattern, and sheen.
- E. Mockup: Construct mock-up of typical stair tread / riser combination including typical details and edge conditions. Locate at construction site.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Certified Wood: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
 - 1. Include statement indicating costs for each product containing certified wood.
 - 2. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
- B. VOC Content of Paints and Coatings: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, suggested schedule for cleaning, [stripping, and re-finishing,] stain removal methods, and polishes and waxes.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum ten years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized between 35 and 50 percent and temperature is stabilized between 65 and 80 degrees F.
 - 1. Do not install wood flooring until wood materials have been acclimated to ambient temperature and humidity conditions for minimum of 72 hours. Stack wood for acclimation procedures to facilitate cross-ventilation of wood materials.
- C. Provide heat, light, and ventilation prior to installation.
- D. Maintain room temperature and humidity in accordance with flooring manufacturers' instructions for period of two days prior to delivery of materials to installation space, during installation, and continuously after installation.

PART 2 PRODUCTS

2.1 HARDWOOD FLOORING

- A. Acceptable Manufacturers:
 - 1. Bruce Hardwood Floors.
 - 2. Harris-Tarkett.
 - 3. Hartco Flooring Co.
 - 4. PermaGrain Products, Inc.
 - 5. Robbins Hardwood Flooring.
 - 6. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Wood Plank Flooring: White Oak.
 - 1. Grade: Clear.
 - 2. Cut: Quarter sawn.
 - 3. Moisture Content: 12 to 14 percent.
 - 4. Actual Thickness: 3/4 inch.
 - 5. Actual Width: 3 inches.
 - 6. Edge: Tongue and Groove.
 - 7. End: End matched.
 - 8. Length: Random, with minimum length of 54".
 - 9. Treatment: Acrylic Impregnated, non-yellowing.
 - 10. Factory Finish: Clear.
- B. Flooring Screws: Type recommended by flooring manufacturer.
- C. Underlayment: Closed cell polyolefin foam; .080 inches thick; 48 inches wide.
- D. Secondary Subflooring: 1/2 inch thick CDX plywood, with square edges, Exposure 1; sanded and painted.
- E. Stair Riser/Nosing: Refer to Section 06 2000.

2.3 ACCESSORIES

- A. Floor Finish: Water-based polyurethane for floor applications, to achieve satin sheen surface. Product similar to MINWAX Water Based Polyurethane for Floors.
- B. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify wood subfloor is properly secured, smooth and flat to plus or minus 1/8 inch in 10 feet.

- C. Verify prefinished wood flooring has been acclimated to ambient temperatures, and acclimation and ambient temperatures are in accordance with prefinished flooring manufacturer's instructions.
- D. Provide a seven day conditioning period for acclimation of the wood prior to installation.

3.2 PREPARATION

- A. Broom clean substrate.
- B. Underlayment: Place underlayment over steel backing structure. Place edges tight together and secure with manufacturer's recommended tape.
- C. Subflooring: Place plywood subflooring over underlayment.
- D. Prepare substrate to receive wood flooring in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. Wood Flooring:
 - 1. Install in accordance with manufacturer's instructions; secure to nail to wood sub-floor.
 - 2. Lay flooring in patterns indicated on Drawings. Verify alignment as work progresses.
 - 3. Arrange flooring with end matched grain set flush and tight.
 - 4. Provide 1/4 inch expansion space at fixed walls and other interruptions.
- B. Provide a seven day conditioning period for acclimation of the wood after installation.

3.4 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean and polish floor surfaces in accordance with manufacturer's instructions.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Protect installed flooring during construction from damage by other trades.

END OF SECTION

SECTION 09 6500

RESILIENT FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Resilient rubber sheet flooring.
 - 2. Resilient rubber base.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3300 - Cast in Place Concrete: Finishing of floor slab.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - 2. ASTM F1344 - Standard Specification for Rubber Floor Tile.
 - 3. ASTM F1861 - Standard Specification for Resilient Wall Base.
- B. Federal Specification Unit:
 - 1. FS L-F-475 - Floor Covering Vinyl, Surface (Tile and Roll), with Backing.
 - 2. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant.
- C. National Fire Protection Association:
 - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate seaming plan.
- C. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- D. Samples:
 - 1. Submit three samples, 4 x 4 inch in size illustrating color and pattern for each resilient flooring product specified.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content : For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.

1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Adhesives and Sealants): Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years experience.
- B. Installer: Company specializing in performing Work of this section with minimum ten years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Protect roll materials from damage by storing on end.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- C. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.9 EXTRA MATERIALS

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish 100 sq ft of flooring, 50 lineal feet of base, of each type and color specified.

PART 2 PRODUCTS

2.1 SHEET FLOORING (RBS-1)

- A. Acceptable Manufacturers:
 - 1. Mondo America.
 - 2. Freudenberg Building Systems, Inc., Nora Rubber Flooring Div.
 - 3. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Basis of Design: 'Harmoni' by Mondo America Inc. Prefabricated rubber sheet flooring calendered and vulcanized with a base of natural and synthetic rubbers, stabilizing agents and pigmentation.
 - 1. Thicknesses: 0.157".
 - 2. Color: Refer to Section 09 0502 for color selection.
 - 3. Finish: Sealskin.
 - 4. Sheet Width: 6'4" wide and 30' to 45' long.
- C. Manufactured in two layers which are vulcanized together. The shore hardness of the top layer will be greater than that of the bottom layer; shore hardness of layers to be recommended by the Manufacturer and the limits specified.
- D. Rubber Sheet: 100 percent rubber composition, color and pattern through total thickness:

2.2 RUBBER TILE (RBT-1)

- A. Acceptable Manufacturers:
 - 1. Mondo America
 - 2. Freudenberg Building Systems, Inc., Nora Rubber Flooring Div.
 - 3. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

- B. Basis of Design: 'Harmoni' by Mondo America Inc. Prefabricated rubber sheet flooring calendered and vulcanized with a base of natural and synthetic rubbers, stabilizing agents and pigmentation.
 - 1. Thicknesses: 0.157" (4mm)
 - 2. Color: Refer to Section 09 0502 for color selection.
 - 3. Size: 24 x 24 inch.

2.3 RESILIENT BASE (RB-1 AND RB-2)

- A. Acceptable Manufacturers:
 - 1. Armstrong Commercial Flooring
 - 2. Flexco
 - 3. Johnsonite, Div. of Duramax, Inc.
 - 4. Freudenberg Building Systems, Inc., Nora Rubber Flooring Div.
 - 5. Roppe Corp.
 - 6. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Base: ASTM F1861 Rubber; top set:
 - 1. Color: Refer to Section 09 0502 for color selection.
 - 2. Height: 4 inch.
 - 3. Coved at concrete or resilient floors. Straight base at carpeted areas.
 - 4. Thickness: 0.125 inch thick.
 - 5. Finish: Satin.
 - 6. Length: Roll.

2.4 ACCESSORIES

- A. Subfloor Filler: Premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Reducer Edge Strips: Same material as flooring; 1-1/4 to 1-1/2" wide by minimum 10 foot lengths, with angled profile, tapering to floor surface.
- D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Prior to installation of resilient flooring systems over the interior concrete slabs, anhydrous calcium chloride testing ASTM F 1869 shall be performed by the Owner's Special Inspector.
- C. Test concrete floors to verify dry to maximum moisture content as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting.

- D. Verify floor and lower wall surfaces are free of substances capable of impairing adhesion of new adhesive and finish materials.

3.2 PREPARATION

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

3.3 INSTALLATION - SHEET FLOORING

- A. Lay flooring with joints and seams in accordance with seaming plan . Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.
- B. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.
- C. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure resilient strips by adhesive.
- D. Install coved base as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.
- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
- C. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.
- D. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.5 INSTALLATION - BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to doorframes and other interruptions.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Remove excess adhesive from floor, base, and wall surfaces without damage.
- C. Clean, seal, and maintain resilient flooring products.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting installed construction.
- B. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 6536

STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Static-dissipative rubber floor tile.
- B. Related Sections:
 - 1. Section 09 6500 - Resilient Flooring: Resilient base, reducer strips, and other accessories installed with static-control resilient floor coverings.

1.2 REFERENCES

- A. American Association of Textile Chemists and Colorists:
 - 1. AATCC-134 – Electrostatic Propensity of Carpets.
- B. ASTM International:
 - 1. ASTM D2047 - 11 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - 2. ASTM D2240 - 05(2010) Standard Test Method for Rubber Property—Durometer Hardness.
 - 3. ASTM E648 - 10e1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - 4. ASTM F150 - 06 Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
 - 5. ASTM F710 - 11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 6. ASTM F970 - 07(2011) Standard Test Method for Static Load Limit
 - 7. ASTM F1344 - 10 Standard Specification for Rubber Floor Tile.
 - 8. ASTM F1869 - 11 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 9. ASTM F2170 - 11 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- C. Federal Test Method Standards
 - 1. Federal Test Method Standard 101C, Method 4046, “Electrostatic Properties of Materials.

1.3 PERFORMANCE REQUIREMENTS

- A. Static-Dissipative Properties: Provide floor coverings with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
 - 1. Static Load Limit: 75 psi in accordance with ASTM-F970.
 - 2. Electrical Resistance: Test per ASTM F 150 with 100-V applied voltage.

- a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
 - b. Average no less than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.
 3. Static Generation: Less than 100 V when tested per AATCC-134 at 12 percent relative humidity and less than 10 volts at 40 percent relative humidity, with conductive footwear.
 4. Static Decay: 5000 to 0 V in less than 0.2 seconds with conductive footwear, when tested per FED-STD-101C/4046.1.
 5. Static Coefficient of Friction (in accordance with ASTM-D2047):
 - a. Typical: Not less than 0.6.
- B. FloorScore Compliance: Static-control resilient flooring shall comply with requirements of FloorScore Standard.
- C. Provide static dissipative tile, adhesive, copper grounding strips supplied by one manufacturer.
- D. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor covering. Include floor covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 1. Show details of special patterns.
 2. Submit grounding diagram showing location of grounding strips and connections.
- C. Samples for Verification: For each type of floor covering indicated and of size indicated below:
 1. Floor Tile: Full-size units.
- D. Qualification Data: For qualified Installer.
- E. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation and seaming method indicated.
 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- C. Preinstallation Conference: Conduct conference at Project site.
 1. Review methods and procedures related to static-control resilient floor coverings including, but not limited to, the following:
 - a. Examination and preparation of substrates to receive floor covering.
 - b. Installation, including seamless installation techniques.
 - c. Field quality-control testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor coverings 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).
 1. Floor Tile: Store on flat surfaces.

1.7 PROJECT CONDITIONS

- A. Close spaces to traffic during floor covering installation.
- B. Close spaces to traffic for 48 hours after floor covering installation.
- C. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS (SDRT-1)

- A. Static-Dissipative Rubber Floor Tile: ASTM F 1344; except in manufacturer's standard hardness when tested per ASTM D 2240 using Shore, Type A durometer.
 1. Smooth-Surface Floor Tile: Class I-B (homogenous rubber, through-mottled pattern).
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Roppe Corporation, ESD Rubber Static Control Tile.
 - 2) Substitutions: Under provisions of Section 01 6000.
 - b. Thickness: Not less than 0.08 inch (2.0 mm).
 - c. Size: 24 by 24 inches (610 by 610 mm).
 - d. Style: Hammered profile
 - e. Seaming Method: Standard.
 - f. Colors and Patterns: Refer to Section 09 0502.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

- B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor covering system to ground connection.
 - 1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR, Subpart D (EPA Method 24):
 - a. Rubber Floor Adhesives: Not more than 60 g/L.
- C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor covering system to ground connection.
- D. Accessories: Transition strips and reducing strips tapered to meet abutting floor surface. Color to match flooring.
- E. Floor Polish: Provide protective, static-control liquid floor polish products when recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Coordinate requirements specified in other Sections for subfloor construction and tolerances to ensure that they are appropriate for types of static-control resilient floor coverings selected.
- B. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- C. 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 or static-control characteristics of floor coverings.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings and electrical continuity of floor covering systems.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Prior to installation of resilient flooring systems over the interior concrete slabs, anhydrous calcium chloride testing ASTM F 1869 shall be performed by the Owner's Special Inspector.

- a. 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.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor coverings until they are same temperature as space where they are to be installed.
 - 1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION, GENERAL

- A. Install static-control resilient floor covering according to manufacturer's written instructions.
- B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor covering surfaces to ground connections.
- C. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings. Extend floor covering to center of door openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Adhere floor coverings to substrates using a full spread of static-control 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 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.
 - 1. Lay floor tiles square with room axis.

- C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified testing agency to test electrical resistance of static-control resilient floor covering systems for compliance with requirements.
 - 1. Arrange for testing after installation static-control adhesives have fully cured and floor covering systems have stabilized to ambient conditions and after ground connections are completed.
 - 2. The electrical resistance will be tested according to ASTM F 150, ANSI/ESD S7.1-2005, NFPA 99, and UL 779. Conduct testing at 100 volts for the ESD Rubber Tile. Perform both point to point and point to ground tests.
- B. See Section 01 4000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Static-control resilient floor coverings will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
- B. Perform the following operations immediately after completing floor covering installation:
 - 1. Remove static-control adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor coverings until Substantial Completion.

END OF SECTION

SECTION 09 6736

STATIC-CONTROL FLUID-APPLIED FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Static Dissipative fluid-applied flooring and base.
- B. Related Sections:
 - 1. Section 03 3000 – Cast-in-Place Concrete: Concrete curing.
 - 2. Section 07 9000 - Joint Sealers: Joint between base and wall surface.
 - 3. Division 26: Grounding of flooring.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 308 – Standard Practice for Curing Concrete.
- B. ASTM International:
 - 1. ASTM D257 - 07 Standard Test Methods for DC Resistance or Conductance of Insulating Materials
 - 2. ASTM E84 - 11b Standard Test Method for Surface Burning Characteristics of Building Materials
 - 3. ASTM F1869 - 11 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 4. ASTM F2170 - 11 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- C. Federal Test Method Standards
 - 1. Federal Test Method Standard 101C, Method 4046, “Electrostatic Properties of Materials.

1.3 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of a pigmented 100 % solids epoxy based static dissipative floor coating system.
- B. The system shall have the color and texture as specified, with a nominal thickness of 24 mils, applied to the prepared area as defined in the plans strictly in accordance with the Manufacturer's recommendations.

1.4 PERFORMANCE REQUIREMENTS

- A. Static-Dissipative Properties: Provide floor coverings with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
 - 1. Surface Resistivity: Test per ASTM D-257; 10^6 - 10^9 Ohms/Square.

2. Voltage Generation: ESD STM 97.2; 14 v with conductive footwear.
3. Static Decay: Mil-Std-3010, Method 4046; 0.01 Seconds.

B. Flame Spread: Class A, per ASTM E84.

1.5 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- B. Samples: Submit three samples of flooring material applied to rigid substrate, illustrating full system, in color as specified.
- C. Manufacturer's Installation Instructions: Indicate special procedures.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing work of this section with minimum ten years' experience.
- C. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.8 PROJECT/SITE CONDITIONS

- A. Site Requirements
 1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
 2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
 3. The Applicator shall ensure that adequate ventilation is available for the work area.
 4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

- B. Conditions of new concrete to be coated with epoxy material.
 - 1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty eight days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
 - 2. Concrete shall have a flat rubbed finish, float or light steel trowel finish.
 - 3. Sealers and curing agents should not to be used.
 - 4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

PART 2 - PRODUCTS

2.1 EPOXY-BASED STATIC DISSIPATIVE SEAMLESS FLOORING (EF-1)

- A. Basis-of-Design Product: Dur-A-Flex, Inc, Dur-A-Gard ESD.
- B. Other Acceptable Manufacturers:
 - 1. Stonehard.
 - 2. General Polymers.
 - 3. Substitutions: Provide equivalent products under provisions of 01 6000.

2.2 MATERIALS

- A. Fluid-Applied Flooring: Epoxy, two component, thermosetting.
 - 1. Primer Coat: Dur-a-glaze #4 ESD Primer resin and hardener, 8 mil dry film thickness.
 - 2. Top Coat: Dur-a-gard ESD, 16 mils dry film thickness.
 - 3. Color: Refer to Section 09 0502.

2.3 ACCESSORIES

- A. Cove Strip: Zinc with projecting base of 1/8 inch (3 mm). For use at coved perimeter base.
- B. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

- C. Verify that concrete sub-floor surfaces are ready for flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by flooring materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. General
 - 1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
 - 2. Moisture Testing: Perform tests recommended by manufacturer and as follows:
 - a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 3 lbs/1,000 sf/24 hrs.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% r
 - c. If the vapor emission exceeds 75 % relative humidity or 3 lbs/1,000 sf/24 hrs then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system. relative humidity level measurement.
 - 3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.
 - 4. Mechanical surface preparation.
 - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 3-4 as described by the International Concrete Repair Institute.
 - b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, or other suitable equipment.
 - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
 - d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.
 - 5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 INSTALLATION - STRIPS

- A. Install cant strips at base of walls where flooring is to be extended up wall as base.
- B. Install base divider strips to match floor pattern. Install terminating cap strip at top of base; attach securely to wall substrate.

3.4 APPLICATION

- A. General
 - 1. The system shall be applied in four distinct steps as listed below:
 - a. Substrate preparation
 - b. Priming
 - c. Install Copper foil tape
 - d. Topcoat application
 - 2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
 - 3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
 - 4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
 - 5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.
- B. Primer
 - 1. The primer shall be applied by notched squeegee and back rolled at the rate of 200 sf/gal, to yield a dry film thickness of 8 mils.
- C. Copper Foil Tape
 - 1. Install copper foil tape conductive adhesive to ground.
 - 2. Use 0.5 inch wide copper foil tape.
 - 3. Copper foil tape is to be installed at one point per 1,000 SF.
- D. Topcoat
 - 1. The topcoat shall be applied by notched squeegee and back rolled applied at the rate of 100 sf/gal to yield a dry film thickness of 16 mils.
 - 2. The topcoat shall be comprised of a liquid resin and hardener that is mixed per the manufacturer's instructions.
 - 3. The finish floor will have a nominal thickness of 24 mils.

3.5 CLEANING AND PROTECTION

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Prohibit traffic on floor finish for 48 hours after installation.
- C. Barricade area to protect flooring until cured.

END OF SECTION

SECTION 09 6813

CARPET TILE

PART 1 GENERAL

1.1 SUMMARY

- A. Prepare surfaces to receive carpeting.
- B. Application of carpet tile.
- C. Application of carpet accessories.
- D. Manufacturers on-site supervision.

1.2 RELATED SECTIONS

- A. Section 01 8113 – Sustainable Design Requirements.
- B. Section 03 3000 - Cast-In-Place Concrete: Finish troweling of concrete floor slabs.
- C. Section 09 3000 - Tile: Floor Finish.
- D. Section 09 6500 - Resilient Flooring: Vinyl Base.

1.3 REFERENCES

- A. Carpet and Rug Institute:
 - 1. CRI 104 - Standard for Installation of Commercial Carpet.
- B. Consumer Products Safety Commission:
 - 1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.
- C. National Fire Protection Association:
 - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of joints, direction of carpet pile and pattern, location of edge moldings and layout per color plan.
- C. Product Data: Submit data on carpet tile, adhesives, and accessories. Describe physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Samples:

1. Submit three sets of carpet tiles illustrating color and pattern designs for each carpet style and color selected.
 2. Submit 6 inch long sample of manufacturers color samples of each type of carpet accessory specified for color selection.
- E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.
- F. Maintenance Manual - Submit manual of carpet manufacturer's recommended maintenance procedures, maintenance equipment and materials, and suggested schedule for cleaning.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. VOC Content of Carpet and Installation Adhesive: Manufacturers' product data for [carpet and carpet cushion] [carpet and installation adhesive] [carpet, carpet cushion, and installation adhesive], including printed statement of VOC content.
1. VOC Limits: Provide carpet that complies with the following limits for VOC content when tested according to ASTM D 5116:
 - a. Total VOCs: 0.5 mg/sq. m x h.
 - b. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
 - c. Formaldehyde: 0.05 mg/sq. m x h.
 - d. Styrene: 0.4 mg/sq. m x h.
 2. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:

- a. Total VOCs: 10.00 mg/sq. m x h.
- b. Formaldehyde: 0.05 mg/sq. m x h.
- c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.7 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Floor Finishes: Comply with the following:
 - a. Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
 - b. CPSC 16 CFR 1630.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years [documented] experience.
- B. Installer: Company specializing in performing work of this section with minimum ten years' experience.
 - 1. FCIB or IFCI certified carpet installers.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Carpet installation to commence only when painting and finishing work is complete and ceilings and overhead work is tested, approved, and completed.
- C. Store materials in area of installation for 48 hours prior to installation.
- D. Maintain minimum 60 degrees F (15 degrees C) for at least 24 hours prior to, during, and after installation. Relative humidity to be approximately that at which area is to be maintained.
- E. Ventilate installation area during installation and for 3 days after installation.
- F. General Contractor shall provide sufficient lighting.

1.10 EXTRA MATERIALS

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.

- B. Provide extra uninstalled carpet in an amount of 5% of the installed yardage for each carpet type and color (pattern) for the Owner's future use.

1.11 WARRANTIES

- A. Specification warranty: Manufacturer warranty that the carpet conforms to the specifications established for the product specified, subject to normal manufacturing tolerances.
- B. Two (2) Year Installation Workmanship Warranty: Provide special project warranty, signed by Contractor and Installer, agreeing to repair or replace defective materials and Contractor's/Installer's/Manufacturer's controls, as judged by Architect at Owner's expense prevailing rates.
- C. Fifteen (15) Year or Lifetime Product Warranty: Carpet warranty by manufacturer for indoor commercial use.
 - 1. The manufacturer guarantees that the surface fiber of this carpet will wear less than 10% by weight of face fiber from abrasion for 15 years or the lifetime of the carpet in normal use. Any area showing greater wear under conditions of normal use will be replaced at the manufacturer's expense including labor charges, as long as the carpet was properly installed and maintained.
 - 2. Warranty shall also cover edge ravel, backing separation, shrinking, stretching and static electricity.

PART 2 PRODUCTS

2.1 CARPET TILE

- A. Carpet: Provide products listed in the Finish Materials Legend Section 09 0502.
 - 1. Substitutions: Under provisions of Section 01 6000 - Product Requirements. Submit samples of proposed type and color for pre-approval.

2.2 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by flooring material manufacturer.
- B. Edge Strips: Provide rubber reducing strips and other items as required. Colors as selected by Architect from manufacturer's standard colors.
- C. Contact Adhesive: As recommended by carpet manufacturer.
- D. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer.
- E. Adhesives: Provide low VOC, releasable adhesive recommended and approved by the carpet manufacturer. Adhesive shall be nonflammable, water-resistant, mildew-resistant, and nonstaining type to suit products and subfloor conditions indicated.

2.3 EDGE BINDING

- A. At all locations where carpet terminates without other trim or transition: “hand sewing” overcast stitch 1/16 inch apart and ½ inch from the edge of the carpet.
- B. Seal the back of the stitching with latex sealer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify floor surfaces are smooth and flat within tolerances specified in Section 03 3000 and are ready to receive work.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Clean substrate.

3.3 INSTALLATION

- A. Install carpet tile in accordance with CRI 104.
- B. Do not mix carpet from different cartons unless from same dye lot.
- C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- D. Install carpet tile in square pattern, with pile direction perpendicular to next unit, set parallel to building lines and aligned as indicated on “Carpet Pattern” detail located on architectural drawing a8.23.
- E. Fully adhere carpet tile to substrate.
- F. Trim carpet tile neatly at walls and around interruptions.
- G. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.

-
- B. On completion of the installation of the carpet, all dirt, carpet scraps, etc. shall be removed from the carpet surface. Any soiled spots or excessive adhesive on the carpet shall be removed with the proper spot remover. All loose pieces of face yarn must be removed with sharp scissors. Leave carpet surface vacuum clean.
 - C. Any damage done to paint, walls, woodwork, doors, and other similar finished surfaces shall be the responsibility of this subcontractor and costs or repairs to the same shall be borne by this subcontractor.

3.5 PROTECTION

- A. Allow installation a minimum of 24 hours before subjecting carpet to any traffic, moving, or furniture, or other heavy equipment.
- B. Protect carpet installation as required from damage until final acceptance. Be responsible for making correction to the work after completion of the installation until final acceptance.

END OF SECTION

SECTION 09 9000

PAINTING AND COATING

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 1. Section 05 5000 - Metal Fabrications: Shop primed items.
 - 2. Section 05 5100 - Metal Stairs: Shop primed items.
 - 3. Section 05 7000 – Decorative Metal Fabrications: Shop primed items.
 - 4. Section 08 1400 – Wood Doors: Shop finished items.
 - 5. Section 09 9600 - High-Performance Coatings.
 - 6. Section 20 0553 - Identification for Mechanical Equipment.
 - 7. Section 26 0553 - Identification for Electrical Systems.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
 - 3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Painting and Decorating Contractors of America:
 - 1. PDCA - Architectural Painting Specification Manual.
- D. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.
- E. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit data on all finishing products to be used.
- C. Samples:
 - 1. Submit three (3) painted samples, minimum 8 inch x 8 inch in size, illustrating selected colors and sheen for each color and system selected, with specified coats cascaded. Submit on stiff paper-backed material. For varnishes and similar transparent coatings, apply finishes on identical type of materials to which they will be applied on job.
 - 2. Identify each sample as to finish, formula, color name and number, sheen name, gloss units, and VOC compliance.
 - 3. Colors to be selected by Architect prior to commencement of work.
- D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, and substrate conditions requiring special attention.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. VOC Content of Paints and Coatings: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.7 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Fire Retardant Finishes: Maximum 25/450-flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 QUALIFICATIONS

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Comply with all current applicable Environmental Protection Agency (EPA), state or local requirements limiting Volatile Organic Compounds (VOC) for architectural and industrial maintenance coatings.
- C. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- D. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
- E. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum temperatures for 24 hours before, during and 48 hours after application of finishes
- F. Minimum Application Temperature for Varnish and Stain Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- G. Provide lighting level of 80 foot candles measured mid-height at substrate surface to be finished.

1.11 SEQUENCING

- A. Section 01 1000 - Summary: Work sequence.
- B. Sequence application to the following:
 - 1. Do not apply finish coats until paintable sealant is applied.
 - 2. Back prime wood trim before installation of trim.

1.12 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.

1.13 EXTRA MATERIALS

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply 1 gallon of each color, type, and surface texture. Tightly seal containers and leave on premises, in location designated by Owner.
- C. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Acceptable Manufacturers for Paint, Transparent Finishes, Stain, Primer Sealers, block Filler, Field Catalyzed Coatings:
 - 1. Benjamin Moore.
 - 2. Diamond Vogel.
 - 3. Glidden Professional.
 - 4. Hirshfields.
 - 5. PPG Architectural Finishes
 - 6. Pratt and Lambert, Inc.
 - 7. Sherwin-Williams Company.
 - 8. Tnemec Companies.
 - 9. Valspar.
 - 10. Substitutions: Under provisions of Section 01 6000.

2.2 COMPONENTS

- A. Material Quality: Provide manufacturer's top-quality grade of each coating type in its consumer line of paint. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- B. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and are recommended by the paint manufacturer for application to the substrates provided, based on testing and field experience for the conditions of service and application methods indicated.
- C. Colors: Match colors as specified by reference to manufacturer's color designations.
- D. Coating Materials: Ready mixed, except field catalyzed coatings. Prepare pigments:
 - 1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
 - 2. For good flow and brushing properties.
 - 3. Capable of drying or curing free of streaks or sags.
- E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.

- F. Patching Materials: Latex filler.
- G. Fastener Head Cover Materials: Latex filler.

2.3 PAINT SHEEN DEFINITIONS

- A. Standard coating terms defined in ASTM D16 apply to the descriptions listed below.
- B. Flat Finish: Refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
- C. Eggshell Finish: Refers to a low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
- D. Satin Finish: Refers to a low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
- E. Semi-gloss Finish: Refers to a medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
- F. Gloss Finish: Refers to a high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report in writing to Architect/Engineer, any condition that may potentially affect proper application
- D. Test shop applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and gypsum wallboard: 12 percent.
 - 2. Masonry, concrete and concrete block: 12 percent.
 - 3. Interior Located Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 5. Concrete Floors: 8 percent.

3.2 PROTECTION

- A. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.
- B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.
- C. Place cotton waste, cloths, and material that may constitute a fire hazard in closed metal containers and remove daily from site.
- D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.
- E. Protect factory or shop finished products installed prior to finishing of adjacent surfaces.
- F. Protect installed sprinkler heads prior to finishing surfaces. Cover head with masking tape or plastic bag.

3.3 PREPARATION

- A. Surfaces: Correct defects and clean surfaces which affect work of this Section. Remove or repair existing coating that exhibit surface defects.
- B. Surface Appurtenances: Remove [or mask] electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- C. Marks: Seal with shellac those which may bleed through surface finishes.
- D. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- E. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.
- F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- G. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove

stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

- J. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, and weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- K. Unprimed Steel Surfaces: Clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
- L. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- M. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- N. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.4 APPLICATION

- A. Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- B. Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as specified, and as recommended by the manufacturer.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, runs, sags, air bubbles and excessive roller stipple.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- H. Prime concealed surfaces of interior and exterior woodwork with primer paint.

- I. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- J. Apply paint adjoining other materials or colors, with clean, sharp edges with no overlapping.
- K. Touch up all suction spots or "hot spots" in plaster or concrete after application of initial coating.
- L. Sandpaper hardwoods between finish coats with fine sandpaper and wipe with a tack rag after each sanding.
- M. Finish side edges of all doors including hardware cutouts and tops and bottoms of exterior doors. Seal tops and bottoms of interior doors with prime coat only.
- N. Paint access panels in the open position, all edges painted.

3.5 FINISHING OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Section 20 0553 and Section 26 0553 for identification banding of equipment, duct work, piping, and conduit.
- B. Paint shop primed equipment where noted on Drawings.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately. Refer to mechanical and electrical sections for primed vs. factory finish.
- D. Protect grilles, light fixtures and access panels delivered with final finish factory applied.
- E. Prime and paint insulated and exposed pipes, conduits, boxes, insulated and exposed ducts, hangers, brackets, collars and supports in rooms scheduled to be painted, except where items are shop finished.
- F. Replace identification markings on mechanical or electrical equipment when painted over or spattered.
- G. Paint interior surfaces of air ducts, convactor and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed immediately behind louvers, grilles, convactor and baseboard cabinets to match face panels.
- H. Paint exposed conduit and electrical equipment occurring in finished areas.
- I. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.6 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect waste material that may constitute fire hazard, place in closed metal containers, and remove daily from site

3.7 PAINTING AND FINISHING SCHEDULE - GENERAL

- A. Paint all materials that are indicated in room finish schedule to receive paint finish.
- B. In rooms with surfaces that are not indicated to be entirely repainted, all finished surfaces that have been patched or restored, are to be painted to match and blend with the existing adjacent surfaces.
- C. Do not paint new materials that have been furnished with a factory applied decorative finish. Do not paint the following materials:
 - 1. Pre-finished wall, ceiling and floor coverings.
 - 2. Acoustical material.
 - 3. Brass, bronze, chromium plate, copper, nickel, stainless steel or aluminum.

3.8 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Metal Fabrications (Section 05 5000): Paint all exposed surfaces of miscellaneous metals such as lintels, angles, etc.
- B. Metal Stairs and Ladders (Section 05 5100): Paint all exposed surfaces of stringers, exposed vertical risers, railings, etc.

3.9 SCHEDULE – EXTERIOR SURFACES

- A. Pavement Markings:
 - 1. Refer to Section 32 1723.
- B. Steel - Shop Primed:
 - 1. Touch-up where needed with primer compatible with shop primer.
 - 2. Two finish coats of exterior alkyd enamel; gloss finish.
 - 3. Finish coat total dry film thickness of not less than 3.0 mils.
- C. Steel - Galvanized:
 - 1. One coat galvanized metal primer; total dry film thickness of not less than 1.2 mils.
 - 2. Two finish coats of exterior alkyd enamel; gloss finish.
 - 3. Finish coat total dry film thickness of not less than 3.0 mils.

3.10 SCHEDULE – INTERIOR SURFACES

- A. Wood - Painted:
 - 1. One coat of acrylic-latex based, interior wood undercoater; total dry film thickness of not less than 1.2 mils.
 - 2. Two finish coats of acrylic-latex, interior enamel; [low-luster (eggshell or satin)] [semi-gloss] finish.
 - 3. Finish coat total dry film thickness of not less than 2.6 mils.
- B. Wood - Transparent:
 - 1. One coat of clear sanding sealer applied at spreading rate recommended by manufacturer.
 - 2. Two finish coats of waterborne acrylic polyurethane varnish applied at spreading rate recommended by manufacturer; low lustre finish.
- C. Concrete (except at Clean Room):
 - 1. Two finish coats of interior acrylic-latex enamel; semi-gloss finish.
 - 2. Finish coat total dry film thickness of not less than 2.6 mils.
- D. Concrete Masonry Units:
 - 1. Two finish coats of interior acrylic-latex enamel; semi-gloss finish.
 - 2. Finish coat total dry film thickness of not less than 2.6 mils.
- E. Steel – Unprimed
 - 1. One coat of rust-inhibitive, alkyd-based or epoxy-metal primer; total dry film thickness of not less than 1.5 mils.
 - 2. Two finish coats of interior odorless, alkyd; semi-gloss finish. One coat of enamel undercoater may be substituted for the first finish coat when recommended by paint manufacturer.
 - 3. Finish coat total dry film thickness of not less than 2.6 mils.
- F. Steel – Primed:
 - 1. Touch-up where needed with primer compatible with shop primer.
 - 2. Two finish coats of interior odorless, alkyd enamel; semi-gloss finish. One coat of enamel undercoater may be substituted for the first finish coat when recommended by paint manufacturer.
 - 3. Finish coat total dry film thickness of not less than 2.6 mils.
- G. Steel - Galvanized:
 - 1. One coat galvanized metal primer; total dry film thickness of not less than 1.2 mils.
 - 2. Two finish coats of interior odorless, alkyd enamel; semi-gloss finish. One coat of enamel undercoater may be substituted for the first finish coat when recommended by paint manufacturer.
 - 3. Finish coat total dry film thickness of not less than 2.6 mils.
- H. Plaster and Gypsum Board:
 - 1. One coat of latex-based, interior primer; total dry film thickness of not less than 1.2 mils.
 - 2. Two finish coats of acrylic-latex interior paint; flat finish at ceiling and soffit applications, and eggshell finish at wall applications.

3. Finish coat total dry film thickness of not less than 2.5 mils for flat finish, and 2.8 mils for eggshell finish.

3.11 SCHEDULE OF PAINT COLORS

- A. Refer to Section 09 0502.

END OF SECTION

SECTION 09 9600

HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Surface preparation, priming and application of epoxy coatings for interior gypsum board and exposed concrete columns, beam edges and ceiling surfaces at Clean Room.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainability Design Requirements:
 - 2. Section 03 3000 – Cast-in-Place Concrete: Finishing of concrete surfaces.
 - 3. Section 09 9000 - Painting and Coating.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. SSPC: The Society for Protective Coatings:
 - 1. SSPC SP 13 – Surface Preparation of Concrete.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on all finishing products to be used.
- C. Samples:
 - 1. Submit three (3) painted samples, minimum 8 inch x 8 inch in size, illustrating selected colors and sheen for each color and system selected, with specified coats cascaded. Submit on stiff paper-backed material.
 - 2. Identify each sample as to finish, formula, color name and number, sheen name, gloss units, and VOC compliance.
 - 3. Colors to be selected by Architect prior to commencement of work.
- D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, and substrate conditions requiring special attention.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. VOC Content of Paints and Coatings: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each

product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit maintenance and cleaning requirements for coatings, repair and patching techniques.

1.6 QUALIFICATIONS

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Comply with all current applicable Environmental Protection Agency (EPA), state or local requirements limiting Volatile Organic Compounds (VOC) for architectural and industrial maintenance coatings.
- C. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- D. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
- E. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum temperatures for 24 hours before, during and 48 hours after application of finishes
- F. Minimum Application Temperature for Varnish and Stain Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- G. Provide lighting level of 80 foot candles measured mid-height at substrate surface to be finished.

- H. At all interior applications provide ventilation of at least 6 air changes per hour during painting and curing operations.

1.9 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.

1.10 EXTRA MATERIALS

- A. Section 01 7000 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply 1 gallon of each color specified, for Owner's maintenance use.
- C. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

PART 2 PRODUCTS

2.1 HIGH PERFORMANCE COATINGS

- A. Acceptable Manufacturers:
 1. Basis of Design: Tnemec Co., Inc..
 2. Carboline Company.
 3. Coronado Paints.
 4. Duron Inc..
 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 GENERAL REQUIREMENTS

- A. Furnish complete multi-coat systems formulated and recommended by manufacturer for applications indicated, in thicknesses indicated
- B. Proprietary names and listed manufacturer represent the specified standard for finish. Products with equivalent characteristics and performance by other approved manufacturers will be accepted.
- C. Material Quality:
 1. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best grade product will not be acceptable.
 2. Lead Content: Lead content in pigment, if any, is limited to contain not more than 0.6% lead as lead metal based on the total non-volatile (dry film) or paint by weight.
 3. Chromium content, as zinc chromate or strontium chromate: None.
 4. Maximum VOC content: As required by applicable regulations.
 5. Color Pigments: Pure, non-fading, application types to suit substrates and service indicated. Color to be as indicated in Section 09 0502.

D. Paint Coordination

1. Review other sections of these specifications in which prime paint are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information in characteristics of finish materials proposed for use, to ensure compatible prime coats are used.
2. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.
3. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

2.3 INTERIOR COATING SYSTEMS

A. Interior Concrete Columns, Beam Edges and Ceiling at Clean Room: Waterborne Acrylic Epoxy System.

1. Surface Preparation: SSPC SP 13 – Surface Preparation of Concrete.
2. First Coat: Tnemec Series 113 Tufcoat.
 - a. Dry film thickness per coat: 4.0 - 6.0 mils.
3. Second Coat: Same as Coat 1.
4. Finish: Satin.
5. Color: PT-8. Refer to Section 09 0502.

B. Interior Gypsum Board Walls at Clean Room: Waterborne Acrylic Epoxy System.

1. Primer: Tnemec Series 151 Elasto-Grip FC.
 - a. Dry film thickness per coat: 0.7 – 1.5 mils
2. First Coat: Tnemec Series 113 Tufcoat.
 - a. Dry film thickness per coat: 4.0 - 6.0 mils.
3. Second Coat: Same as Coat 1.
4. Finish: Satin.
5. Color: PT-8. Refer to Section 09 0502.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces are ready to receive work as instructed by coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions otherwise detrimental to formation of a durable paint film.

3.2 PREPARATION

- A. General

1. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified for each particular substrate condition.
 2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.
- B. Cementitious Materials
1. Prepare cementitious surfaces of concrete to be painted by removing efflorescence, chalk, dust, dirt, grease, and oils.
 2. Concrete surfaces are to be smooth and free of bugholes and imperfections greater than 1/16 inch in diameter.
 3. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 4. Mechanically abrade to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide smooth surface profile. (Reference SSPC-SP13, ICRI CSP3-9) All Surfaces must be clean, dry and free of oil, grease and other contaminants.

3.3 MATERIAL PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Maintain limited storage quantities as acceptable to the Fire Department.
- C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film, and if necessary, strain material before using.

3.4 APPLICATION

- A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
 1. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, weld and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

- B. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate to establish a total dry film thickness as recommended by coating manufacturer.
- D. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
 - 1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- E. Pigmented (Opaque) Finishes
 - 1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.

3.5 CLEAN-UP AND PROTECTION

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
 - 1. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting as acceptable to Architect.
 - 1. Provide "Wet Paint" signs as required to protect newly painted finishes.
 - 2. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
 - 3. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.
 - 4. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.6 SCHEDULE

- A. Colors: As indicated in Section 09 5020.

END OF SECTION

SECTION 09 9656

FLOORING MOISTURE MITIGATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Surface applied moisture mitigation system.
 - 1. For use at Clean Room (Rm No 1-180) concrete floor.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 – Cast-In-Place Concrete: Restrictions on curing compounds.
 - 3. Section 09 6736 – Static-Control Fluid-Applied Flooring: Epoxy floor finish.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D 4541 B - Pull-Off Strength of Coatings; 1995, Modified.
 - 2. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - 3. ASTM E 1907 - Standard Practices for Determining Moisture-Related Acceptability of Concrete Floors to Receive Moisture-Sensitive Finishes.
 - 4. ASTM E 648-03 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems using a Radiant Heat Energy Source.
 - 5. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 6. ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and MSDS (Material Safety Data Sheet) for each product.
- B. Independent Test Data: Submit independent testing laboratory data for products indicating the following:
 - 1. ASTM E 96, Water Vapor Transmission (wet method) Performance shall be documented by an independent testing laboratory at a minimum of 97% water vapor transmission reduction compared to untreated concrete.
 - 2. ASTM E96- Perm Rating - Standard Test Method for Water Vapor Transmission of Materials – Perm Rate results must not exceed 0.1 Perms.
 - 3. ASTM D 1308; Insensitivity to alkaline environment up to, and including, pH 14. A 14 day test is required with no degradation of sample reported.
 - 4. Certify acceptance and exposure to continuous topical water exposure after final cure.
- C. Field Testing: Submit anhydrous calcium chloride testing according to ASTM F 1869 and/or RH Probe Test according to ASTM F 2170. Tests shall be performed by the

Owner's Special Inspector and results provided to the Architect, Owner, General Contractor, and Water Vapor Reduction System Manufacturer's Representative.

- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing work of this section with minimum ten years' experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store in a dry, well ventilated area at minimum 50 deg F (10 deg C) and maximum 90 deg F (32 deg C).
- B. Deliver materials in manufacturer's unopened containers fully identified with brand, type, grade, class and all other qualifying information. Provide Material Safety Data Sheets for each product.

1.6 ENVIRONMENTAL CONDITIONS

- A. Do not apply moisture vapor reduction system to unprotected surfaces or when water is accumulated on the surface of the concrete.
- B. Do not apply water vapor reduction system when temperature is lower than 50°F or expected to fall below this temperature within 24 hours from time of application.

1.7 PROTECTION

- A. Protect water vapor reduction system to prevent damage from active rain or topical water for a minimum period of 24 hours from time of application.

1.8 COORDINATION

- A. Prior to installation of rubber flooring, and/or epoxy flooring systems over the interior concrete slabs, anhydrous calcium chloride testing ASTM F 1869 and/or RH Probe Tests ASTM F 2170 shall be performed by the Owner's Special Inspector.
- B. The Contractor will coordinate with the Owner's Special Inspector scheduling water vapor reduction system testing and allowing enough time to test, submit and install the water vapor reduction system before installation of floor finish.
- C. The Owner's Special Inspector will be allowed as much time as is reasonable for the concrete slab to dry before installing anhydrous calcium chloride tests and/or RH

Probe Tests. All mastics, glues, and/or contaminants shall be removed to provide a clean, sound, concrete substrate prior to installing anhydrous calcium chloride tests as per ASTM F 1869 (latest revision).

- D. The water vapor reduction system must allow installation as early as 7 days after concrete placement.

PART 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS

- A. Provide one of the following products:
1. VAP I-2000 by Koester American Corporation (Basis of design).
 2. Vaportight SG3 by Aquafin.
 3. MC Moisture Control System by Ardex.
 4. Planiseal EMB by Mapei.
 5. Substitutions: under provisions of Section 01 6000.

2.2 MATERIALS

- A. General: Use materials of one manufacturer throughout the project.
- B. Epoxy coating; System to provide the following characteristics and properties in a one coat system. No multi-coat systems allowed. System must contain 100% epoxy resin solids.
1. ASTM E 96, Water Vapor Transmission (wet methods) Performance shall be documented by an independent testing laboratory at a minimum 97% for water vapor transmission reduction compared to untreated concrete.
 2. ASTM E 96 Permeance Rating – product cannot exceed a 0.1 permeance rating
 3. ASTM D 1308; Insensitivity to alkaline environment up to, and including, pH 14 in a 14 day bath test.
 4. Certify acceptance and exposure to continuous topical water exposure after final cure.
 5. Water Vapor reduction system shall be a single coat, stand alone system with no requirements for additional components such as sand broadcast for adhesion of flooring systems.
 6. System must reduce Calcium Chloride readings of up to 25lbs/1000 ft²/24 hrs by 97% in one coat. System must be able to perform as required with RH Probe readings of 100%.
- C. Patching Compounds: Provide manufacturer's standard patching compounds designed to encapsulate moisture barriers.
- D. Primer: Manufacturer's recommended compatible primer.
- E. Leveling Compounds: Provide manufacturer's standard hydraulic cement based concrete leveling compounds as required for areas requiring leveling of the original concrete floors slabs prior to installation of moisture mitigation products.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine all construction substrates and conditions under which concrete floor sealer material is to be installed. Do not proceed with the concrete floor sealer installation until unsatisfactory conditions are corrected.
- B. Assure that surfaces to be treated do not contain any kind of sealer or organic compounds.
- C. Moisture Testing: Owner's Special Inspector will test substrates for moisture vapor emissions in accordance with ASTM F1869 and ASTM F 2170. Proceed with installation only after substrates pass testing.
 - 1. 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. in 24 hours.
 - 2. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- D. Adhesion tests:
 - 1. The Owner's Special Inspector shall verify proper adhesion of flooring adhesives, coatings, and leveling compounds to the final vapor reduction coating system for acceptability.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive concrete floor sealer.
- B. Substrate preparation:
 - 1. Clean all surfaces to receive moisture vapor reduction system. Shot blast all floors to a Concrete Surface Profile (CSP) #3 or #4 and clean surfaces with an industrial vacuum cleaner and remove all residues from the substrate. Grinding is allowed only in areas not accessible by shot blasting. Acid etching and the use of sweeping compounds and solvents are not acceptable means of preparing the concrete.
 - 2. Remove ALL defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, Shot blast beads, etc.
 - 3. Burn off reinforcing fibers and collect and vacuum remains.
 - 4. Repair all cracks, expansion joints, control joints, and open surface honeycombs and fill in accordance with Manufacturer's recommendations
 - 5. Treat saw cut and expansion joints as per manufacturer's application guideline.
 - 6. Install cementitious underlayment, leveling mortars, flash patching, on top of surface applied concrete floor sealer.
 - 7. Do not apply floor sealer to unprotected surfaces or surfaces where water has accumulated (puddles).

3.3 INSTALLATION

- A. Install components for moisture mitigation, including crack repair materials, leveling compounds, moisture barriers, and patching compounds in accordance with manufacturer's written instructions.
- B. Starting installation constitutes acceptance of sub-floor conditions.
- C. Where system stops, terminate under centerline of door and at wall edges.
- D. Where required for level surface, install leveling course as per manufacturer's specifications and recommendations.
- E. Where water based adhesives are used in the floor covering installation, use an approved underlayment system with primer prior to the installation of the flooring system. Consult the adhesive manufacturer for their minimum recommended thickness of cementitious underlayment to absorb excess moisture in the adhesive.

3.4 CLEANING

- A. Remove all debris resulting from water vapor reduction system installation from project site.

3.5 FIELD QUALITY CONTROL

- A. Provide documentation that moisture mitigation system is installed in accordance with manufacturer's instructions including the following:
 - 1. ICRI Concrete Surface Profile achieved by abrasive blasting prior to installation.
 - 2. Patching or leveling required prior to application of moisture mitigation coating.
 - 3. Application rate of moisture mitigation coating (square feet per gallon).
 - 4. Thickness of leveling compound applied on top of moisture mitigation coating.
- B. Replacement/repair: where records or inspection indicate system was not installed in sufficient thickness to meet manufacturer's requirements, remove, and repair or replace as required to comply with manufacturers installation requirements.

3.6 PROTECTION

- A. Protect each coat during specified cure period from any kind of traffic, topical water and contaminants.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY SURFACES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. Porcelain marker boards within laboratory spaces.
 - 2. Glass marker boards
 - 3. Tackboards.
- B. Related Sections:
 - 1. Section 08 8000 – Glazing: Glass components.
 - 2. Section 09 2116 – Gypsum Board Assemblies: Sheet metal backing plate.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A208.1 - Mat-Formed Wood Particleboard.
- B. ASTM International:
 - 1. ASTM A424 - Standard Specification for Steel, Sheet, for Porcelain Enameling.
 - 2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 5. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
 - 6. ASTM C1396/C1396M - Standard Specification for Gypsum Wallboard.
 - 7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 - 2. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- D. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate wall elevations, dimensions, joint locations, and special anchor details.
- C. Product Data: Submit data on markerboards, tackboards, tackboard surface covering, and trim and accessories.
- D. Samples: Submit three samples illustrating materials and finish, color and texture of the following:
 - 1. 6 x 6 inch samples of porcelain marker board.
 - 2. 12 x 12 inch samples of tack board assembly, including tack board surfacing.
 - 3. 12 x 12 inch samples of glass marker board panel.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Certified Wood: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
 - 1. Include statement indicating costs for each product containing certified wood.
 - 2. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
- C. VOC Content of Adhesives and Sealants: Manufacturers' product data for installation adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

- A. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

- B. Flame Resistant Fabric: Passes when tested in accordance with NFPA 701, Test 1 or Test 2.

1.7 QUALIFICATIONS

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

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Section 01 7000 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for visual display boards.
- C. Warranty: Include coverage of porcelain markerboard surface from discoloration due to cleaning, crazing or cracking.

PART 2 PRODUCTS

2.1 VISUAL DISPLAY BOARDS

- A. Manufacturers:
 - 1. Claridge Products and Equipment.
 - 2. Egan Visual, Inc.
 - 3. Neal Slate Company
 - 4. US Markerboard
 - 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Markerboards (MBD): Porcelain enamel on steel, laminated to core.
 - 1. Color: White.
 - 2. Metal Face Sheet Thickness: 0.024 inch (24 gage).
 - 3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
 - 4. Backing: Aluminum foil, laminated to core.
 - 5. Size: As indicated on drawings.
 - 6. Frame: Extruded aluminum, with concealed fasteners.
 - 7. Frame Finish: Anodized, natural.
 - 8. Accessories:
 - a. Provide chalk rail by Arch Hardware, Inc.; 1/8" thick anodized aluminum with 3/4" lip x 4" deep with a 2 3/4" back, in 8 foot lengths.

2.2 TACKBOARDS (TBD)

- A. Tackboards: Acoustical wall carpet laminated to homosote backing.
 - 1. Basis of design: 'Acousticord' wall carpet laminated to 1/2" homosote backing.

2. Color: ACS-31, Chamois, with horizontal direction.
3. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E 84.
4. Size: As indicated on drawings.
5. Frame: Extruded aluminum, with concealed fasteners unless detailed and noted otherwise on drawings.
6. Frame Profile: As indicated on drawings

2.3 GLASS MARKER BOARDS (GMBD)

- A. Glass Marker Boards: Laminated glass panels.
 1. Glass Units: Laminated clear low iron glass composed of two plies of 1/8" float glass and one ply of opaque .030" pvb interlayer. See Section 08 8000 for additional glass description.
 2. Glass Unit Thickness: 1/4 inch.
 3. Opacity: 100%
 4. PVB Interlayer Color: Ultra White.
 5. Comply with requirements for safety glazing.
 6. Accessories:
 - a. Where noted on Drawings provide chalk rail by Arch Hardware, Inc.; 1/8" thick anodized aluminum with 3/4" lip x 4" deep with a 2 3/4" back, in 8 foot lengths.

2.4 COMPONENTS

- A. Porcelain Enameled Steel Sheet: ASTM A 424, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Tackboard Substrate: Homosote PINnacle NCFR, Class A boards, square edge.
- C. Hardboard: ANSI A135.4, tempered, smooth face.
- D. Frame and Chalk Rail: Aluminum extrusions, ASTM B221, 6061 alloy,

2.5 ACCESSORIES

- A. Adhesives: Type used by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify internal wall blocking is ready to receive Work and positioning dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Secure units level and plumb.
- B. Markerboards: Butt panels tight with concealed spline to hairline joint.

3.3 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.

END OF SECTION

SECTION 10 2113

METAL TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal toilet compartments and urinal screens.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 06 1053 – Miscellaneous Rough Carpentry: Concealed wood framing and blocking for compartment support.
 - 3. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A117.1 – 2003 - Standard for Accessible and Usable Buildings and Facilities
- B. ASTM International:
 - 1. ASTM A424 - Standard Specification for Steel, Sheet, for Porcelain Enameling.
 - 2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- C. Federal Specification Unit:
 - 1. FS A-A-60003 - Partitions, Toilet, Complete.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, and floor supports, and door swings.
- C. Product Data: Submit data on panel construction, hardware, and accessories.
- D. Samples: Submit three 6 x 6 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Materials Reuse: For materials that will be salvaged or refurbished.

1. Provide receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
- B. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 requirements for accessible toilet compartments.
- B. Comply with Americans with Disabilities Act (ADA) accessibility guidelines.

1.6 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work with placement of support framing and anchors in wall.

1.7 WARRANTY

- A. Provide manufacturer's standard five year warranty against corrosion or discoloration of stainless steel partitions,

PART 2 PRODUCTS

2.1 METAL TOILET COMPARTMENTS

- A. Acceptable Manufacturers:
 1. Accurate Partitions Corp.
 2. Flush Metal Partition Corp.
 3. Global Steel Products.
 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Product Description: Floor mounted and overhead braced, toilet compartments, urinal and screens.

2.2 COMPONENTS

- A. Steel Sheet: ASTM A653/A653M, with G90 zinc coating.
- B. Stainless Steel Sheet: ASTM A666, Type 304 in #4 satin finish.
- C. Toilet Compartments: FS A-A-60003; Stainless steel, floor-mounted headrail-braced.

- D. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening honeycomb core, formed and closed edges, mitered and welded corners ground smooth.
 - 1. Panel and Door Faces: 22 gauge stainless steel
 - 2. Pilaster Faces: 22 gauge
 - 3. Reinforcement: 12 gauge.
 - 4. Internal Reinforcement: Furnish in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.
- E. Door and Panel Dimensions:
 - 1. Thickness: 1 inch.
 - 2. Door Width: 24 inch.
 - 3. Accessible Door Width: 32 inch minimum clear opening, per ANSI 117.1.
 - 4. Height: 58 inches.
 - 5. Typical Stall Depth: 60 inches.
- F. Pilasters: 1-1/4 inch thick, of sizes required to suit compartment width and spacing.
- G. Urinal screens: Wall mounted with three panel brackets.

2.3 ACCESSORIES

- A. Hinges: Stainless steel die cast hinge shall have gravity acting cam and wrap around flanges. Upper and lower door hinges are recessed.
- B. Pilaster Shoes: One-piece, formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- C. Head Rails: Hollow stainless steel tube, 1 x 1-5/8 inch size, with anti-grip profile and cast socket wall brackets.
- D. Brackets: Satin stainless steel.
- E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- F. Hardware: Stainless steel:
 - 1. Die cast hinge shall have gravity acting cam and wrap around flanges. Upper and lower door hinges are recessed with adjustable door close positioning; two for each door.
 - 2. Nylon bearings.
 - 3. Barrier-free, concealed latch with emergency access and ADA lever handle.
 - 4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 5. Coat hook with rubber bumper; one for each compartment, mounted on side panel and functioning as a door stop.
 - 6. Furnish one door pull for outswinging doors of standard compartments.
 - 7. Per the Minnesota State Building Code, furnish two door pulls for outswinging doors of accessible compartments. Mount one door pull on each side of door.

2.4 FACTORY FINISHING

- A. Stainless Steel Compartments: AISI No. 4 finish, with grain (belting) running long dimension of component.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify field measurements are as indicated on shop drawings.
- C. Verify correct spacing of and between plumbing fixtures.
- D. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- A. Maintain 3/8 to 1/2 inch maximum space between wall and panels and between wall and end pilasters.
- B. Attach panel brackets securely to walls using anchor devices.
- C. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.3 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Indicated Position: 1/4 inch.
- C. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- C. Adjust hinges to position doors in partial opened position when unlatched. Return out swinging doors to closed position.
- D. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2213

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wire mesh system for walls and access doors.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 08 7100 - Door Hardware: Cylinders for locksets.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 3. ASTM A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
 - 4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 5. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 6. ASTM C847 - Standard Specification for Metal Lath.
- B. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- C. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.

1.3 DESIGN REQUIREMENTS

- A. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
- B. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Include component details, framed

openings, bearing, anchorage, [loading,] type and location of fasteners, and accessories or items required of related work.

- C. Product Data: Submit data for screen materials and finishes.
- D. Samples: Submit two 6 x 6 samples, inch in size illustrating screen material. Submit samples of latchset illustrating style, color, and finish.
- E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. VOC Content of Paints and Coatings: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.6 QUALIFICATIONS

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

1.7 FIELD MEASUREMENTS

- A. Verify field measurements are as shown on Drawings.

PART 2 PRODUCTS

2.1 WIRE MESH PARTITIONS

- A. Acceptable Manufacturers:
 - 1. Acorn Wire Mesh Partitions.
 - 2. The G-S Co.
 - 3. Miller Wire Works.
 - 4. Wire Crafters, Inc.
 - 5. Standard Wire and Steel Works.
 - 6. Central Wire and Iron.

7. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. General: Provide wire mesh partitions in layout shown on drawings.
- B. Configuration:
1. Refer to drawings for layout.
 2. Partitions shall be framed to fit with 2 inches nominal clearance around pipes, ducts and structure. Cap bar installation and access into floor sockets shall require top rail to be a minimum of 3 inches clear of overhead structure.
 3. Panel modules shall be 10 feet high and a maximum of 5 feet wide.
 4. Provide anchors and fasteners appropriate for substrate material.
- C. Framing Members: ASTM A500, Grade B cold formed steel channels.
1. Vertical Members: 1-1/4 inch by 5/8 inch 'C' section channels.
 2. Horizontal Frames: 1 inch by 1/2 inch channels with all joints mortise and tendon.
 3. Cap Rail: 2-1/4 inches by 1 inch channel.
 4. Corner and Intersecting Posts: 1-1/4 by 1-1/4 inch by 1/8 inch angle for 90 degree corners, 1-1/4 by 1-1/4 inch tubes for 3 and 4 way intersections.
 5. Hinged Door Frames: 1-1/4 inches by 1/2 inch by 11 gage channel with 1/8 inch by 1-1/4 inches flat bar band on three sides, 1-3/8 inches by 3/4 inch angle welded to lock side. Each door to have 1-1/2 pairs butt hinges welded to both door and transom bar, and a mortise type cylinder lock. Access from outside to be key, inside by recessed knurled knob. to be 1-1/4 x 3/4 inch channel with flat bar cover three sides.
- D. Chain Link Fabric: 1 1/2 inch diamond woven mesh galvanized steel with vinyl coated wire, interwoven, 10 gage thick, top selvage twisted tight, bottom selvage knuckle end closed; including tension bars, tension wire, and accessories.
1. Provide a maximum of 5'-0" wide panels and use custom width filler panels in widths as needed to fill out runs.
- E. Doors:
1. Provide 3'-0" x 7'-0" hinged doors in both single leaf and in pairs – refer to Drawings for locations.
 2. Hinges: Each door to have 1 1/2 pairs butt hinges riveted to both door and hinge bar.
 3. Gate Locks: All door openings shall have mortise type cylinder gate lock with active lever handle on the inside and dummy (nonoperable) lever handle on the outside face. Operation shall be by key on the outside and lever handle on the inside. Lock to be equivalent to Multi Lock Inc., Series 400.
 4. Cylinder locks to be provided by Section 08 7100.
 5. Provide all bolts, hardware, and accessories for complete installation.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Bolts, Nuts and Washers: Hot dip galvanized.
- H. Anchorage Devices: Power driven or Power actuated.

- I. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of structure.

2.3 ACCESSORIES

- A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- C. Post Caps: Manufacturer's standard.
- D. Floor and Ceiling Pilaster Shoe: Manufacturer's standard.
- E. Touch-Up Primer for Galvanized Surfaces: As recommended by manufacturer.

2.4 FABRICATION

- A. Fit and assemble in largest practical sections for delivery to site, ready for installation.
- B. Make exposed joints flush or tight.
- C. Furnish components required for anchorage to adjacent construction.
- D. Frame openings made for penetrating mechanical and electrical components.
- E. Fabricate door for hinged operation.

2.5 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Provide finishes as follows:
 - 1. For Room 1-180 (Clean Room): Electrostatically sprayed enamel; color to be black.
 - 2. For Room 1-166 (Loading Dock): Galvanized finish.
- C. Galvanizing: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness]; galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and required openings are ready to receive work.

3.2 PREPARATION

- A. Clean substrate surfaces.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation from Plumb or Level: 1/4 inch.
- C. Maximum Misalignment From Indicated Position: 1/4 inch.

3.5 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust hinged doors to achieve free movement.

END OF SECTION

SECTION 10 2600

WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes corner guards and wall protection crash rails..
- B. Related Sections:
 - 1. Section 05 5000 - Metal Fabrications: Concealed in wall plates for attachment of Work of this section.
 - 2. Section 09 2113 – Gypsum Board Assemblies: Sheet metal backing plates for wall crash rails.

1.2 PERFORMANCE REQUIREMENTS

- A. Installed Wall Rail Component Assembly: Support vertical live load of 100 lb/lineal ft with deflection not to exceed 1/50 of span between supports.
- B. Installed Component Assembly: Resist lateral force of 75 lbs at any point without damage or permanent set.
- C. Corner Guards: Resist lateral impact force of 100 lbs at any point without damage or permanent set.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit physical dimensions, features, anchorage details, and rough-in measurements.
- C. Samples: Submit three sections of corner guard, 24 inch long, illustrating component design, configuration, color and finish.
- D. Manufacturer's Installation Instructions: Submit procedures, and perimeter conditions requiring special attention.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.5 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with wall or partition sections for installation of concealed blocking or anchor devices.

PART 2 PRODUCTS

2.1 WALL AND CORNER GUARDS

- A. Acceptable Manufacturers:
 - 1. Arden Architectural Specialties Inc.
 - 2. Construction Specialties Inc.
 - 3. IPC Door & Wall Protection Systems
 - 4. Pawling Corp.
 - 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

- B. Wall protection crash rails:
 - 1. Basis of Design: Arden Architectural Specialties.
 - 2. Wallwear Model CRE-4SSC stainless steel crash rail with I-beam mounting bracket.

- C. Corner Guards:
 - 1. Basis of Design: Arden Architectural Specialties.
 - 2. Wallwear Model CG-SS series stainless steel corner guard with variable wings.

2.2 COMPONENTS

- A. Crash Rail: Factory- or shop-fabricated, with preformed end caps and internal and external corners:
 - 1. Performance of Installed Assembly:
 - a. Support vertical live load of 100 lb/lineal ft with deflection not to exceed 1/50 of span between supports.
 - b. Resist lateral force of 250 lbs at any point without damage or permanent set.
 - 2. Material: Type 304 stainless steel, No. 4 finish. 0.25 inch thick.
 - 3. Mounting Surface: Varies, refer to Drawings. Typically substrate is gypsum wall board on metal studs or concrete masonry.
 - 4. Mounting Bracket Depth: 3"
 - 5. Return rail to wall.
 - 6. Length: Minimum one piece length not less than 96 inches, unless a shorter length is required due to the floor plan. Use minimum number of pieces to accomplish run. Provide flush splicing between sections.

- B. Corner Guard - Surface Mounted:
 - 1. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 - 2. Material: Type 304 stainless steel, No. 4 finish. 0.0625 inch.
 - 3. Length: One piece in length as shown on Drawings.
 - 4. Wings: 3" long.
 - 5. Corner Radius 1/8"
 - 6. Length: Two sizes are required; 36" and 96". Refer to drawings for locations.

- C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.3 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify rough-in for components are correctly sized and located.

3.2 INSTALLATION

- A. Crash Rail:
 - 1. Guard shall be securely locked in place over continuous metal retainer. Provide for free floating action under impact without damage to guard, retainer, or adjacent wall.
 - 2. Retainers shall be securely affixed to wall through bumper cushions with fasteners provided. Maximum spacing 16" o.c. Fasteners must be securely attached to metal studs or steel channel blocking.
 - 3. Toggle bolt attachment to gypsum wallboard at points other than metal studs or steel sheet blocking is not permitted.
- B. Position corner guard immediately above wall base.
- C. Terminate rails 6 inches short of door openings.

3.3 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Required Height for Horizontal Rails: 1/4 inch.
- C. Maximum Variation From Level or Plane For Visible Length for Horizontal Rails: 1/4 inch.

END OF SECTION

SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Toilet accessories.
 - 2. Utility room accessories.
 - 3. Adult changing station.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 06 1053 – Miscellaneous Rough Carpentry: Concealed wood blocking for support of grab bars.
 - 3. Section 09 2116 – Gypsum Board Assemblies: In-wall framing and plates for support of accessories.
 - 4. Section 10 2113 – Metal Toilet Compartments.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 5. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 7. ASTM C1036 - Standard Specification for Flat Glass.

- B. Federal Specification Unit:
 - 1. FS A-A-3002 - Mirrors, Glass.

1.3 DESIGN REQUIREMENTS

- A. Design grab bars, shower seats and attachments to resist minimum 250 lb (0.22 kN) concentrated load applied at any point in any direction.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.
- C. Samples: Submit two samples of each accessory material illustrating color and finish.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

1.6 QUALITY ASSURANCE

- A. Flame Resistant Fabric: Passes when tested in accordance with NFPA 701, Test 1 or Test 2.

1.7 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.1 TOILET AND BATH ACCESSORIES

- A. Acceptable Manufacturers:
 - 1. Bobrick Washroom Equipment.
 - 2. Bradley Corp.
 - 3. Georgia Pacific
 - 4. Gojo
 - 5. Royce Rolls Ringer Company.
 - 6. Technical Concepts.
 - 7. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.

2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269, stainless steel.
- D. Galvanized Sheet Steel: ASTM A653, G90 zinc coatng.
- E. Adhesive: Two-component epoxy type, waterproof.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.
- G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 TOILET ROOM ACCESSORIES

- A. Products listed below are based on University of Minnesota preferred products
Substitutions are not permitted unless specifically allowed below.
- B. Toilet Paper Dispenser: Surface-mounted, dual side-by-side partition mounting,
stainless steel unit. Provide Model T-2 by Royce Rolls Ringer Company.
- C. Paper Towel Dispenser for Rest Rooms: Motion Activated Touchless Paper Towel
Dispenser.
 1. Products by enMotion Item #59462. Color: Translucent Smoke.
- D. Paper Towel Dispenser for Laboratories: Push Paddle Roll Paper Towel Dispenser.
 1. Products by Georgia-Pacific; Model "Vista", Item #54338. Color: Black.
- E. Semi-Recessed Waste Receptacle: 22 gauge, Type 304 stainless steel, one piece,
seamless construction with removable front panel for cleaning. Continuously welded
bottom pan and seamless exposed one piece flanges.
 1. Product: Equivalent to Contura Series Model # B-43644 manufactured by
Bobrick Washroom Equipment.
 2. Liner: Integrated bag holder for securing disposable plastic trash bags.
 3. Minimum capacity: 12.5 gallons.
 4. Substitutions: Under provisions of Section 01 6000.
- F. Surface Mounted Waste Receptacle: 20 gauge, Type 304 stainless steel, one piece,
seamless construction with removable front panel for cleaning. Continuously welded
bottom pan and seamless exposed one piece flanges.
 1. Product: Equivalent to Contura Series Model # B-277 manufactured by Bobrick
Washroom Equipment.
 2. Liner: Integrated bag holder for securing disposable plastic trash bags.
 3. Minimum capacity: 12.5 gallons.
 4. Substitutions: Under provisions of Section 01 6000.
- G. Wall mounted Soap Dispenser: Battery powered touch free liquid soap dispenser.
 1. For use at rest rooms – refer to Drawings for locations.

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2. Product: Technical Concepts, TC AutoFoam Touch-Free Dispenser, Model #750127.
 3. Color: Black with Black insert.
 4. Minimum Capacity: 1100 ml.
- H. Wall mounted Soap Dispenser: Push operation liquid soap dispenser.
1. For use at laboratories – refer to Drawings for locations.
 2. Product: Gojo FMX-12 Dispenser.
 3. Color: Dove Gray.
 4. Minimum Capacity: 1250 ml.
- I. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed mounting flange with snap flange; 1-1/2 inches clearance between wall and inside of grab bar.
1. Length and configuration: As indicated on Drawings.
 2. Product: Equivalent to Series B-6806 (18 gauge) manufactured by Bobrick Washroom Equipment.
 3. Substitutions: Under provisions of Section 01 6000.
- J. Combination Sanitary Napkin/Tampon Dispenser: Stainless steel, semi-recessed.
1. Door: Seamless 18 gauge door with returned edges and tumbler lock.
 2. Cabinet: Fully welded, 0.03 inch thick sheet.
 3. Operation: 25 cent coin required to operate dispenser. Provide locked coin box, separately keyed.
 4. Identify dispensers without using brand names.
 5. Minimum capacity: 25 napkins and 20 tampons.
 6. Product: Equivalent to Contura Series, Model #B-47064 25 manufactured by Bobrick Washroom Equipment.
 7. Substitutions: Under provisions of Section 01 6000.
- K. Surface Mounted Sanitary Napkin Disposal Unit: 22 gauge Type 304 stainless steel, surface-mounted, with one-piece cover with full-length stainless steel piano-type hinge, removable receptacle.
1. Product: Equivalent to Contura Series, Model #B-270 manufactured by Bobrick Washroom Equipment.
 2. Substitutions: Under provisions of Section 01 6000.
- L. Adult Changing Table: Full 304 brushed stainless steel exterior with vacuum formed polystyrene changing surface and 400 lb. load rating to exceed ASTM F2285 requirements for weight bearing changing stations
1. Acceptable product: Foundations Worldwide, Inc.; Model 100-SSE-R (Horizontal Recessed Mount) with .A.D.A Compliant attached buckle.
 2. Characteristics:
 - a. Table dimensions: Nominal 18" by 62".
 - b. Body to be 16 gauge, 304 brushed stainless steel, with seamless welds.
 - c. Provide SS-Flange in order to surface mount unit.
 - d. Provide stainless steel liner dispenser.
 - e. Equip with pneumatic cylinders.
 3. Substitutions: Under provisions of Section 01 6000.

2.4 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 18 gauge stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 - 1. Mop/broom holders: 3 spring-loaded rubber cam holders at shelf front.
 - 2. Four stainless steel hooks.
 - 3. Length: 34 inches long, 8 inches deep.
 - 4. Product: Equivalent to Model # B-224 manufactured by Bobrick Washroom Equipment.
 - 5. Provide one per Janitors room.
 - 6. Substitutions: Under provisions of Section 01 6000.

2.5 FACTORY FINISHING

- A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.
- B. Galvanizing for Items Other than Sheet: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.
- C. Galvanizing for Nuts, Bolts and Washers: ASTM A153/A153M.
- D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify exact location of accessories for installation.
- C. Verify field measurements are as indicated on product data.
- D. Wall Reinforcing:
 - 1. See Section 09 2116 for installation of reinforcing plates and concealed anchors in walls for accessories.
 - 2. See Section 06 1053 for installation of wood blocking for grab bars.
 - 3. Coordinate installation of blocking, reinforcing plates, and concealed anchors in walls.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Install plumb and level, securely and rigidly anchored to substrate.
- B. Mounting Heights and Locations: As indicated on Drawings.

END OF SECTION

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire extinguishers; fire blankets; fire extinguisher cabinets; and brackets for wall mounting.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 06 1053 - Miscellaneous Rough Carpentry: Wood blocking and shims.
 - 3. Section 09 2116 – Gypsum Board Assemblies: Roughed-in wall openings.
 - 4. Section 09 9000 - Painting and Coating: Field applied paint finish.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 10 - Standard for Portable Fire Extinguishers.
- B. Underwriters Laboratories Inc.:
 - 1. UL - Fire Protection Equipment Directory.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10 code.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.
- C. Provide fire extinguisher cabinets classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, fire ratings, and location.
- C. Product Data: Submit extinguisher operational features, color and finish, and anchorage details.
- D. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install extinguishers when ambient temperature are capable of freezing extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Acceptable manufacturers include:
 - 1. Grinnell Corp.
 - 2. JL Industries.
 - 3. Kidde Fire Extinguishers.
 - 4. Larsen's Manufacturing Co.
 - 5. Nystrom Products Co.
- B. Substitutions: Under provision of Section 01 6000 - Product Requirements
- C. Multi-Purpose Use: Dry Chemical Type: Equivalent to J. L. Industries Cosmic 10E, 10 pound Class ABC dry chemical, UL Rating 4A-60BC. Use Mark MB846 bracket for wall mounting.
- D. Extinguisher Finish: Stainless steel with in #4 satin finish.

2.2 FIRE EXTINGUISHER CABINETS

- A. Acceptable Manufacturers:
 - 1. JL Industries Model.
 - 2. Larsen's Manufacturing Co.
 - 3. Substitutions: Under provisions of Section 01 6000 - Product Requirements.
- B. Fire Extinguisher Cabinets (FEC): Equivalent to J.L. Industries Model Cavalier Series, Model No. 1056; unlettered.
 - 1. Trim Type: Semi-recessed with 2 1/2 inch projection type, sized to accommodate accessories.
 - 2. Tub Size: Interior dimensions of 10 1/2 inches wide x 24 inches high x 6 inches deep.
 - 3. Door Style: "Contemporary V" style, reinforced for flatness and rigidity; latch access, with standard pull.
 - 4. Exterior Metal: Stainless steel in #4 satin finish
 - 5. Interior Finish: White enamel.
 - 6. Fire Rated: Refer to wall ratings noted on Drawings.
- C. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim.
- D. Pre-drill for anchors.
- E. Hinge doors for 180 degree opening. Furnish roller type catch.
- F. Weld, fill, and grind components smooth.
- G. Glaze doors with resilient channel gasket glazing.

2.3 ACCESSORIES

- A. Fire Extinguisher Brackets: Equivalent to J. L. Industries Mark MB Series wall bracket.

2.4 LOCKBOX

- A. Recessed Heavy Duty Lock Box: The Knox Company, Model 3200-R, UL listed, 4 inches wide by 5 inches high by 3 inches deep, black baked enamel finish, without alarm tamper switch.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install cabinets plumb and level in wall openings, maximum 48 inches from finished floor to top of extinguisher handle.
- B. Install wall brackets, maximum 48 inches from finished floor to top of extinguisher handle.
- C. Secure rigidly in place.
- D. Place extinguishers and accessories in cabinets.

END OF SECTION

SECTION 10 5113

METAL LOCKERS

1.1 SUMMARY

- A. Section includes metal lockers and accessories.
 - 1. Cleanroom gowning area lockers.
 - 2. Corridor lockers in Corridor 1-170.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000- Cast-In-Place Concrete: Concrete base.
 - 3. Section 06 1053 - Miscellaneous Rough Carpentry: Wood grounds and attachment strips.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate locker plans, elevations, sections, details and attachments to other Work.
 - 1. Show locker fillers, trim, base, sloping tops, and accessories. Include locker numbering plan.
- C. Product Data: Submit data on locker types, sizes and accessories.
- D. Samples:
 - 1. Lockers: Submit three samples, 3 x 6 inches in size, of each color scheduled; applied to specified base metal.
- E. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.

4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. VOC Content of Paints and Coatings: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.5 QUALITY ASSURANCE

- A. Obtain locker units and accessories through one source from a single manufacturer.
- B. Regulatory Requirements: Unless otherwise indicated, metal lockers are to comply with accessibility requirements under the "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and facilities) ADAAG".
 1. Provide hardware that does not require tight grasping, pinching or twisting of the wrist and that operates with a force of not more than 5 lbf.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.1 LOCKERS

- A. Acceptable Manufacturers:
 1. Basis of Design: Lyon Metal Products, Inc., All Welded Lockers
 2. Penco Products, Inc.
 3. Republic Storage Systems Co., Inc.
 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 ALL WELDED STEEL LOCKERS

- A. Construction: All welded. Pre-assembled, with seams and joints welded. Bolts, screws, and rivets not used in assembly of locker bodies.
- B. Materials:
 1. Steel: ASTM A 1008, Class I, mild-annealed, cold-rolled steel, free from surface imperfections.
 2. Fasteners: Zinc plated or other comparable rust-retardant treatment.
- C. Body:
 1. 16-gauge steel.
 2. Flanged to give double thickness of metal at back, top, and bottom of sides, top, and bottom.
 3. Backs: 1-piece for each locker module, 18-gauge steel.
 4. Tops: 1-piece for each locker module, 16-gauge steel.

5. Bottoms: 1-piece for each locker module, 16-gauge steel, with front and back channel reinforcements.
 6. Seams and Joints: MIG welded.
- D. Door Frame:
1. Integral part of sides, top, and bottom of locker.
 2. Side Containing Latch: Additional flange to form door strike.
 3. Tops, Bottoms, and Intermediate Bottoms: Additional flange to form door strike at top and bottom of door.
- E. Doors:
1. One piece, 14-gauge steel.
 2. Both vertical edges formed into channel-shaped formation. Top and bottom flanged at 90-degree angle.
 3. Multiple Tier Locker Doors: 18-gauge steel pan stiffener welded on 6-inch centers inside channel-shaped formation of hinge side of door.
 4. Door Thickness: 1 inch. All locker body components made of cold rolled steel formed for added strength and rigidity and to ensure tight joints at fastening points.
 5. Sound deadening door panels and lock bars.
 6. Handle: Manufacturers standard tamper proof handle.

2.3 LOCKER TYPES

- A. Locker Unit Type I (Corridor 1-170): Heavy duty, fully welded lockers with all locker body components made of cold rolled steel formed for added strength and rigidity and to ensure tight joints at fastening points
1. Width: 12 inches.
 2. Depth: 18 inches.
 3. Height: 78 inches.
 4. Configuration: Double and four tier. Refer to elevations for layout.
 5. Mounting: Surface mounted.
 6. Base: 4" cast-in-place concrete base.
 7. Top: Flat metal with closures.
 8. Locking: Two types are required.
 - a. Coin operated locks for 32 individual four tier lockers (8 bays). Coin collection type, by School Lockers, SOM-S-6ML or equivalent by alternate manufacturer. Provide master key for overall access.
 - b. Built-in locks with master key cylinder locks for remainder of lockers.
 9. Ventilation Method: Door louvers.
 10. Type: Quiet.
- B. Locker Unit Type 2 (Cleanroom Gowning Room):
1. Width: 12 inches.
 2. Depth: 18 inches.
 3. Height: 12 inches.
 4. Configuration: Four tier.
 5. Mounting: Surface mounted.
 6. Base: 12" high custom metal pedestal leg base. To allow locker unit to be moved for cleaning below.
 7. Top: Sloped metal with closures.

8. Locking: Equipped for built-in locks with master key cylinder locks.
9. Ventilation Method: Door louvers.

2.4 ACCESSORIES

- A. For Each Half Height Locker: One double prong wall zinc plated hook and rubber bumper.

2.5 FABRICATION

- A. Fabricate lockers square, rigid, without warp, with metal faces flat and free of distortion.
- B. Welded Lockers: Pre-assemble lockers by welding into one piece structures in groupings most practical for job requirements, welds free of burrs. No bolts, nuts, or rivets allowed in assembly of main locker groups.
- C. Doors: Welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
- D. Hinges: Full length; weld securely to locker body and door.
- E. Number Plates: Furnish rectangular shaped aluminum plates. Form numbers of block font style, in contrasting color.
- F. Furnish ventilation openings at top and bottom of each locker.
- G. Form recess for operating handle and locking device.
- H. Finish edges smooth without burrs.
- I. Fabricate sloped metal tops, ends and closure pieces.

2.6 FACTORY FINISHING

- A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel paint.
- B. Electrostatically paint locker units of one color throughout.
- C. Color: To be selected from manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify prepared bases are in correct position and configuration.

- C. Verify bases and embedded anchors are properly sized.

3.2 INSTALLATION

- A. Install lockers in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install lockers plumb, level, square, rigid, with flush installation.
- C. Use manufacturer's supplied hardware
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.
- E. Joints: Provide flush hairline joints against adjacent surfaces.
- F. Number Plates: Attach number plates to face of doors level with 2 aluminum rivets. Attach in sequence as indicated on the Drawings.
- G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- H. Remove and replace defective or damaged components that cannot be successfully repaired as determined by Architect.

3.3 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean locker interiors and exterior surfaces.

3.4 PROTECTION

- A. Protect installed lockers from damage during construction

END OF SECTION

SECTION 11 0114

FALL ARREST AND RESTRAINT SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Design, supply and installation of a complete fall arrest & restraint system.
 - 2. Rooftop fall arrest and fall restraint anchors with steel pipe uprights and baseplate.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 3000 – Cast-in-Place Concrete
 - 3. Section 07 5113 – Asphalt Roofing

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Contractor, roofing and deck subcontractors, Owner's Representative, manufacturer's representative, and other affected trades before beginning work of this Section.
- B. Coordinate with Owner's Window Washing Procedures to interface with the work of this section.
 - 1. Portions of the fall arrest and fall restraint system may be utilized as part of the window washing system. Coordinate design to minimize duplication of anchor points and other hardware and maximize Owner's use of the roof area for safe maintenance.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show rooftop locations of fall arrest anchors, configurations, dimensions, attachment details, and components required for complete fall arrest system complying with provisions of this Section and all applicable Federal, State and Local Regulations.
 - 2. Show interface with adjacent materials.
 - 3. Bear seal and signature of structural engineer, employed by manufacturer, licensed in State in which the project is located, responsible for design.
- B. Product Data: Descriptive product literature, with pertinent data highlighted. Include physical characteristics, performance data, and limitations.
- C. Structural Calculations:
 - 1. Bear seal and signature of structural engineer, employed by manufacturer, licensed in the state in which the project is located, responsible for design.

- D. **Manufacturer's Instructions:** Include Installation Instructions, special procedures, and conditions requiring special attention.
- E. **Certification:** Written statement signed by manufacturer's authorized representative.
 - 1. Certify each welding operator as currently certified by AWS qualification test for welding. Conforming to AWS D1.1, AWS D1.2, and AWS D1.3.
 - 2. Certify that fall arrest system complies with provisions of this Section and is suitable for type of roofing, roof deck, location on roof, and to maintain watertight seal.
 - 3. Certify installer as certified installer by manufacturer.
- F. **Project Record Drawings:** Submit under provisions of Section 01 7000. Show location of each fall arrest anchor as installed.
 - 1. Submit two copies of reduced plastic laminated as-built drawing showing anchor locations and details for posting near roof access points;
- G. **Maintenance and Operating Data:** Submit under provisions of Section 017800 Include manufacturer's maintenance procedures, safety inspection log book for yearly inspections, manufacturer's videotape illustrating usage of fall arrest and fall restraint systems, and on-site personal instructions to Owner's personnel in use of equipment.

1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A manufacturer specializing in the design, fabrication and installation of window cleaning and suspended maintenance systems and:
 - 1. With minimum of 5 years documented experience.
 - 2. Carrying specific liability insurance (products and completed operations) to protect against product/system failure.
- B. **Installer Qualifications:** Employed by or approved by manufacturer.
- C. **Welding:** Perform welding by welding operators currently certified by AWS qualification test for welding.

1.5 QUALIFICATIONS

- A. **Manufacturer:**
 - 1. Company specializing in work of this Section with minimum 5 years documented experience.
 - 2. Employing complete engineering and technical personnel needed to engineer, design, and perform work of this Section.
- B. **Installer:**
 - 1. Company specializing in work of this section with minimum 5 years documented experience on jobs of this scale and complexity.
 - a. Able to document successful installations of manufacturer's fall arrest/fall restraint systems.
 - 2. Either same as manufacturer or certified by manufacturer as qualified to perform work of this Section.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Comply with provisions of Section 01 6000 and manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Probel Group Limited 1-800-461-0575. www.probel.ca
- B. Guardian Fall Protection, Tel. 1-800-466-6385, Fax 1-800-670-7892, Web Site <http://www.guardianfall.com>.

2.2 DESIGN REQUIREMENTS

- A. Comply with referenced Federal and State Industrial Safety Regulations, and standards listed above for fall arrest and fall restraint systems.
- B. Design fall arrest anchor system to allow free movement of persons over entire roof while attached by full body harness, retractable life line or vertical life line to catenary lines attached to D-ring or eye at each fall arrest anchor. Include quick release attachments.
- C. Design upright anchors as instructed by manufacture in layout acceptable to Architect and Owner.
- D. Design to safety factor to meet ASME A120.1 for structural connections and components. Design per loads below unless modified by Safety regulations or ASME A 120.1:
 - 1. Design fall arrest system for one person.
 - 2. Design fall arrest anchors with permanent attachments to roof structure to resist 5,000 pounds per AISC/LRFD criteria or 3,125 pounds per AISC/ASD criteria.
 - 3. Design fall arrest system to limit fall distance to 6 foot and to limit arrest force to 1,800 pounds or less.

2.3 STEEL PLATE, WIRE ROPE AND UPRIGHT MATERIALS

- A. Steel Pipe: Schedule 80 ASTM A 53 Type F.
- B. Steel Plate: ASTM A 1011 Grade 45 or ASTM A 570 Hot rolled formed.
- C. Steel D-Ring Eyelets: ASTM F 887, Drop Forged, 5,000 pound Proof Load, 3/8 by 2 inch steel. Galvanize per ASTM A 153.

2.4 ACCESSORIES

- A. Full Body Harness (Two Each): Heavy-duty weather resistant construction vest with built-in harness and 2 D Ring lanyards.

2.5 FASTENERS

- A. Bolts, Nuts and Washers: Hot-dip galvanize, ASTM A 153, Class C or D.
- B. Exposed Fasteners: Powers/Rawl, No. 12 Perma-Seal HWH Deck Screw with non-corrosive coating. Gasket with EPDM washers, specified for type and quality, and as designated by manufacturer for design loads.

2.6 FLASHING AND SEALING MATERIALS

- A. Universal Pipe Flashing: Weathertight EPDM rubber boot.
- B. Non-Expanding Sealing Gaskets: Pre-cut and predrilled, .40 durometer, 1/8 inch, solid neoprene rubber meeting or exceeding ASTM D 2000. For sealing under anchor bases.
- C. Expanding Compression Gaskets: 1/4 inch neoprene rubber meeting or exceeding ASTM D 1056 Type I (Closed Cell), Class B or C (Petroleum Resistant). For sealing under steel flashing cap.
- D. Steel Flashing Cap: Minimum 26 gauge stainless steel. Configured with boxed corners to fit tightly over plate and compression gasket and with factory cut penetration configured to upright. Predrilled holes at corners for attachment with mechanical fasteners.
- E. Joint Sealants: Non-skinning butyl sealant for hidden sheet metal flashing joints. Neutral curing silicone sealant for all other uses. Both sealants as specified Section 079005, and as suitable to installation.

2.7 FABRICATION

- A. Connections: Weld and grind smooth. Comply with AWS D1.1, AWS D1.2, and AWS D1.2, as applicable.
- B. Fabricate engineered fall restraint and fall arrest system suitable for roof and deck mounting with welded steel base plate and steel pipe uprights.
- C. Pre-drill holes for fasteners at baseplate.

2.8 FINISHES

- A. Steel Pipe Upright and Base Plate Fabrications: ASTM A 123 or ASTM A 153 hot-dip galvanize after fabrication. Include fabricated uprights, plates, and D-rings.
- B. Galvanizing Repair Compound: 95% zinc cold galvanizing compound specified for type and quality. Field touch up damaged galvanizing surface finishes with galvanized finish with galvanizing repair compound.
- C. Pre-Finished Flashing:
 - 1. 1. Finish: Prefinished as specified Section 07 6200, or manufacturers standard baked-on siliconized polyester.
 - 2. Color: Black

- D. Full Body Harness Color: As accepted by Owner's Representative from manufacturer's standard selection and conforming to ANSI Z53.1

PART 3 EXECUTION

3.1 EXAMINATION

- A. Any layout shown by Architect is for design intent only. Verify spacing and other requirements.
- B. Verify conditions as satisfactory to receive work of this Section. Do no work until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Install fall arrest system in accordance with manufacturer's instructions and provisions of Contract Documents. Where in conflict assume more stringent requirements and verify with Owner's Representative before beginning work.
- B. Install upright fall arrest anchors to comply with design requirements as necessary for watertight, secure, permanent attachment.
- C. Isolate dissimilar metals to prevent contact.

3.3 FIELD QUALITY CONTROL

- A. Visually inspect all field welds.

3.4 ADJUSTING

- A. Repair or replace defective installations not conforming with provisions of Contract Documents.

3.5 SCHEDULE

- A. Refer to Drawings for locations.

END OF SECTION

SECTION 11 1319

LOADING DOCK EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Prefabricated steel leveler; operating hardware.
 - 2. Prefabricated dock bumpers with attachment frame.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 03 1000 - Concrete Forming and Accessories
 - 3. Section 03 3000 - Cast-In-Place Concrete: Concrete pit.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- C. Underwriters Laboratories Inc.:
 - 1. UL - Electrical Appliance and Utilization Equipment Directory.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate required opening dimensions, tolerances of opening dimensions, placement dimensions, and perimeter conditions of construction, power and control wiring and power diagrams.
- C. Product Data: Submit materials and finish, installation details, roughing-in measurements, operation of unit.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit operating instructions, identify unit limitations. Submit unit maintenance information, lubrication cycles, spare parts manual.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 DOCK LEVELERS AND BUMPERS

- A. Acceptable Manufacturers:
 - 1. Advanced Lifts, Inc.
 - 2. Blue Giant USA Corp.
 - 3. Kelley Dock Systems.
 - 4. W.B. McGuire Co., Inc.
 - 5. Rite-Hite Corp.
- B. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 LEVELER COMPONENTS

- A. Leveler: ANSI MH14.1, Fixed type.
 - 1. Equivalent to Kelley Company, "aFX", 45,000 pound capacity, 6'-0" x 8'-0".
 - 2. Fully mechanical requiring no manual lifting to operate.
 - 3. Include Manufacturer's standard dock bumpers.
 - 4. Lip to automatically extend with 18" lip projection beyond bumpers.
 - 5. Provide full operating range; yellow toe guards to meet OSHA requirements.
- B. Leveler Pit Frame: Galvanized Steel angle, 3 x 3 x 1/4 inch; mitered and welded corners, fitted with headed stud anchors for concrete embedment.
- C. Attachment Hardware: Galvanized bolts and expansion shields and/or "L" shaped anchor rods for casting into concrete.

2.3 BUMPERS

- A. Bumpers:: Molded rubber, ozone resistant, nylon reinforced, minimum Shore A Durometer of 70 tensile strength of 950 to 1050 psi:
 - 1. Thickness From Wall: 6 inches.
 - 2. Vertical Height: 10 inches.
 - 3. Width: 8'-0" inches.
 - 4. Profile: Rectangular.
 - 5. Location: Loading dock at trash dumpster stall.
- B. Attachment Hardware: 3/4 inch diameter galvanized bolts and expansion shields for anchoring into concrete.

- C. Touch-up Primer: Zinc rich type.

2.4 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: In accordance with Section 26 0503 and the following:
 - 1. 120 volts, single phase, 60 Hz.
- B. Motors: NEMA MG 1.
- C. Controls: Single push button control panel; wall mounted. Refer to Drawings for location.
- D. Disconnect Switch: Factory mount disconnect switch on equipment.

2.5 FACTORY FINISHING

- A. Leveler Platform: Factory enameled finish.
- B. Leveler Frame: Factory enameled finish.
- C. Pit Frame: Hot dip galvanized to 1.25 oz/sq ft finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify rough-in opening is acceptable.

3.2 PREPARATION

- A. Coordinate pit frame and integral anchor placement by Section 03 1000.

3.3 INSTALLATION

- A. Install dock leveler unit in prepared opening.
- B. Set square and level.
- C. Anchor unit securely, flush with dock. Weld back of leveling dock to pit frame. Touch-up weld with primer.

3.4 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust installed unit and safety vehicle device for smooth and balanced operation.

3.5 DEMONSTRATION AND TRAINING

- A. Demonstrate operation and maintenance requirements to Owner's personnel.

END OF SECTION

SECTION 11 5213

PROJECTION SCREENS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electrically operated exposed mounted projection screens.
 - 2. Manually operated exposed mounted projection screens.
 - 3. Related accessories.

- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 5000 – Metal Fabrications: Supports for suspended projection screens.
 - 3. Section 09 5113 – Acoustical Panel Ceilings: Suspended panel ceilings for recessed screens.
 - 4. Division 26 – Equipment Wiring: Electrical supply, conduit, and wiring for electric motor operated projection screens.

1.2 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.

- B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Wiring diagrams for motor operators and actuators, and controls and switches.

- C. Shop Drawings: Submit manufacturer's wiring diagram for electrically operated controls. Also detailed drawings concealed mounting.

- D. Samples: Submit three samples, 6 x 6 inch in size illustrating screen case prefinished components, and screen surface.

- E. Manufacturer's Installation Instructions: Submit detailed installation instructions including rough-in measurements.

- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

- B. Operation and Maintenance Data:
 - 1. Submit parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
 - 2. Submit technical information for servicing operating equipment.

1.4 QUALIFICATIONS

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in installation of products specified in this section with minimum ten years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver projection screens after building is enclosed, other work within spaces where screens are to be installed is substantially complete, and installation of screens is ready to take place.
- B. Protect projection screens from damage before, during and after installation.
- C. Acclimate screens to building temperatures for 24 hours prior to installation, or in accordance with manufacturer's recommendations.

1.6 FIELD CONDITIONS

- A. Maintain interior of building between 60 degrees F and 75 degrees F during and after installation of projection screens.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 5 year manufacturer warranty for projection screen.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers
 - 1. Basis of Design: Da-Lite Screen Company
 - 2. Bretford: www.bretford.com.
 - 3. Draper, Inc: www.draperinc.com.
 - 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 PROJECTION SCREEN - ELECTRICALLY OPERATED EXPOSED

- A. Type: Da-Lite Advantage Electrol Model #37102
 - 1. Single Motor Low Voltage Control (LVC), built in.
 - 2. Viewing Surface: High contrast matte white.

3. Size: Nine (9) feet high by twelve (12) feet wide.
 4. For use at Conference Room 1-102.
- B. Mounting: Designed and fabricated for ceiling installation as scheduled with appropriate hardware.

2.3 PROJECTION SCREEN - MANUALLY OPERATED-METAL CASE

- A. Type: Da-Lite Model B, Model #92735
1. Viewing Surface: High contrast matte white.
 2. Size: Eight (8) feet wide by Eight (8) feet wide.
 3. Accessories: Type No. 6 wall mounting brackets and pull rod.
 4. For use at Conference Rooms 1-106, 1-108, and 2-107.
- B. Screen Case: Steel, minimum 22 gage, top mounting hooks for hanging from mounting brackets, white baked enamel finish color.
- C. Provide accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

2.4 ELECTRICAL COMPONENTS

- A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.
- B. Motors: Direct drive, 110 V, 60 Hz.
1. Screen Motor: Mounted inside roller; three wire with ground; quick reverse type; equipped with thermal overload cut-off.
 - a. Electrical Characteristics: up to 3 amps.
 - b. Motor mounted on sound absorber.
- C. Screen Control: Single station, Remote control, UL listed control switch for each screen with metal device box and cover plate for flush wall mounting and for connection to 120 Volts AC electric power supply.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify that substrate is finished and ready to accept installation of screen and projector mounts.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Verify that openings for recessed screens are correctly sized.

- E. Verify type and location of electrical connections.
- F. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.2 PREPARATION

- A. Coordinate screen installation with installation of projection systems.
- B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.3 INSTALLATION

- A. Install projection screens at location indicated on Drawings.
- B. Coordinate with electrical connection.
- C. Coordinate installation with ceiling finishes for application of ceiling finish to screen case bottom panels.
- D. Securely anchor to supporting substrate.
- E. Install to produce smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when lowered.
- F. Test electrically-operated units to verify screen controls, limit switches, closure and other operating components are in optimum functioning conditions.

3.4 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for balancing and adjusting.
- B. Adjust installed unit for smooth and balanced operation.

3.5 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Remove protective coverings from finished surfaces. Clean surfaces and components ready for inspection.

3.6 DEMONSTRATION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate electrically operated projection screens to Owner. Allow two hours duration for demonstration.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Do not permit use of projection screens after installation.

END OF SECTION

SECTION 11 5310 – LABORATORY CASEWORK AND OTHER FURNISHINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wood Laboratory Casework and Tables
- B. Metal Laboratory Casework, Tables, and Casework Systems
 - 1. Metal Laboratory Casework and Tables
- C. Cabinet Hardware
- D. Laboratory Work Surfaces
- E. Mobile Workstation
- F. Shelving Assemblies
- G. Cylinder and Dewar Restraint Assembly
- H. Overhead Service Carriers
- I. Cable Tray System
- J. Wall-Mounted Attachment Channel
- K. Pipe Drop Enclosure
- L. Drying Rack
- M. Cable Grommet
- N. Laser Curtain and Track Assembly
- O. Clean Room Softwall
- P. Finish for Miscellaneous Wood Items
- Q. Metal Fabrications
- R. Stainless Steel Fabrications
- S. Slotted Channel Framing (Strut)
- T. Sealant

1.2 RELATED SECTIONS

- A. Division 01 - Mockups

- B. Division 09 – Flooring (wall base)
- C. Section 11 5313 – Fume Hoods and Other Air Containment Units
- D. Section 11 5343 – Laboratory Service Fittings and Fixtures
- E. Division 23 – Mechanical
- F. Division 22 – Plumbing
- G. Division 23 – Heating, Ventilated, and Air-Conditioning
- H. Division 26 – Electrical
- I. Division 27 - Communications

1.3 REFERENCES

- A. Architectural Woodwork Institute, Woodwork Institute, and Architectural Woodwork Manufacturers Association of Canada: Architectural Woodwork Standards (AWS), Edition 1, October 2009.
- B. Builders Hardware Manufacturers Association: ANSI/BHMA A156.18-2006 American National Standard for Materials and Finishes, 2006.
- C. Hardwood Plywood & Veneer Association: ANSI/HPVA HP-1-2004 Standard for Hardwood and Decorative Plywood, 2004.
- D. National Hardwood Lumber Association: NHLA Rules for the Measurement & Inspection of Hardwood & Cypress, 2007.
- E. Scientific Equipment and Furniture Association: SEFA 2-2010 SEFA Recommended Practices for the Installation of Scientific Laboratory Furniture and Equipment.
- F. Scientific Equipment and Furniture Association: SEFA 3-2010 SEFA Recommended Practices for Work Surfaces.
- G. Scientific Equipment and Furniture Association: SEFA 8W-2010 Recommended Practices for Laboratory Grade Wood Casework.
- H. Scientific Equipment and Furniture Association: SEFA 8M-2010 Recommended Practices for Laboratory Grade Metal Casework.
- I. Scientific Equipment and Furniture Association: SEFA 8PL-2010 Recommended Practices for Laboratory Grade Plastic Laminate Casework.
- J. Scientific Equipment and Furniture Association: SEFA 8PH-2010 Recommended Practices for Laboratory Grade Phenolic Casework.
- K. Scientific Equipment and Furniture Association: SEFA 8P-2010 Recommended Practices for Laboratory Grade Polypropylene Casework.

1.4 BID SUBMITTALS

- A. Certification of Compliance: All bidders (including those listed in 2.01-A) must submit a compliance certification statement indicating that their bid includes products and installation which comply with every requirement of the project specifications and drawings (accounting for any RFI responses received during the bidding phase).
- B. Certification of Qualifications: All bidders must submit a certification of compliance with the Qualifications requirements outlined below. List specific project experience as evidence of compliance.
- C. Substitution Requests: All substitution requests for this scope of work in this section must be made during the bidding phase. No substitution requests will be considered post-bid.

1.5 SUBMITTALS

- A. Refer to General Conditions and Division 1 "Submittal Procedures" for submittal requirements. In addition to these requirements, provide submittal requirements specified herein.
- B. Submittal requirements:
 - 1. Submittal shall be prepared individually for this specification section. Arrange product data, drawings and information for submission in a complete set for this specification section.
 - a. Shop drawings and product data as applicable for required mockups may be submitted separately and should be expedited for submittal as soon as the contract is awarded.
 - b. Shop drawings may be submitted on a floor-by-floor (building-by-building) basis. However, product data and details shall not be submitted redundantly with each submission.
 - 2. Submittal shall contain complete data for all items of this specification section. Periodic or partial submittals of individual components within this specification section will be returned as incomplete and rejected.
 - 3. Submittals shall be organized by specification sequence with section and paragraph number identified.
 - 4. Equipment and components being proposed shall be clearly labeled with all options and accessories indicated and shall be for this specific project. All non-applicable items shall be deleted or struck.
 - 5. Product data submittals provided in PDF format shall consist of fully collated PDF files allowing for collated printing from a single file.
- C. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for work in this section.
 - 1. Product data shall not be duplicative or redundant with shop drawings. Do not include drawings in the product data submittal that are included in the shop drawings.
- D. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducible, PDF files, or photocopies, to scale, sheet size not to exceed 11 inches x 17 inches (A3). Shop drawing submittals provided in PDF format shall consist of fully collated files allowing for collated printing from a single file. Blueline prints are not acceptable.

- E. **Approved Substitution/Approved Equal:** In addition to the items required in Division 1, all substitution requests shall include item-by-item comparison of the proposed substitution to this project specification. A copy of the project specification shall be submitted, with each item and subsection of the project specification marked as “Comply” or “Not Comply.” In any cases where “Not Comply” is indicated, an explanation of the relative advantages of the proposed design shall be provided.
- F. **Submit detailed anchorage and attachment drawings** provided by a licensed Structural Engineer complying with applicable codes, regulations, and guidelines in the state of installation.
- G. **Samples: Accompanying Materials List,** submit for Architect's approval two (2) samples of each type of specified finish and color range available for casework, laboratory work surfaces, painted steel fabrications, cabinet hardware, and shelving.
- H. **Certifications/ Test Data:** Submit certifications and test data as required elsewhere in this section, including evidence of AWI membership, SEFA structural performance test reports, and finish performance test reports.
- I. **Operations/Maintenance Manuals:** At project close-out, submit for Architect's review and Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and closest factory representative for components and service.
- J. **Warranty:** Submit manufacturer's warranty including any additional certifications as needed to meet the requirements specified.

1.6 MOCKUP

- A. Provide and install products within this scope of work as part of the laboratory mockup, as indicated on the drawings.
- B. **Location of mockup:**
 - 1. At location provided by the laboratory subcontractor, such as the factory.
- C. **Disposition of mockup:**
 - 1. Mockup items may be incorporated into the final project subject to approval and/or corrections as identified in the mockup review.
 - 2. Mockup items will remain the property of the laboratory subcontractor.
- D. The mockup will be reviewed and appropriate comments documented. The mockup – and the associated comments - will become a quality sample against which the remainder of the product installation will be compared.
- E. Coordinate delivery, installation, and review of the mockup with the contractor. The mockup should be complete and reviewed prior to fabrication of the remainder of the project. To the extent that the subcontractor elects to fabricate the project prior to review and approval of the mockup, it is understood that this is “at risk” and items may require re-fabrication to address issues that arise from the mockup review.

1.7 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades.
- B. Replacement: Any damaged work shall be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to the Owner.

1.8 ENVIRONMENTAL CONDITIONS

- A. It is the responsibility of the general contractor or construction manager to provide appropriate environmental conditions within the laboratory spaces throughout the period of installation of wood and composite wood casework products until substantial completion of the project and turnover to the owner. The relative humidity standards as delineated by the Architectural Woodwork Institute Quality Standards (8th Edition, Version 2.0) should be followed.
 - 1. Humidity must be controlled between 25% and 55% in all areas where laboratory casework is stored and/or installed.
 - 2. The range of relative humidity change should not exceed 30 percentage points.
- B. It is the responsibility of the laboratory furniture subcontractor to assess building environmental conditions prior to the delivery and installation of laboratory casework. Wood laboratory casework shall not, under any circumstances, be installed in spaces which do not comply with the requirements outlined above.

1.9 QUALIFICATIONS

- A. Work in this section shall be manufactured by and installed by a company/companies having a minimum of eight years documented experience providing and installing products similar to those specified in laboratory applications; an established organization; and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of products specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified work of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

1.10 ENVIRONMENTAL COMPLIANCE

1.11 WARRANTY

- A. All products will be warranted to be free from defects in materials and workmanship for a period of two following substantial completion. The manufacturer/dealer/subcontractor shall repair or replace any products (or parts thereof) that are found to be defective. Replacement will include any parts, labor, shipping, and travel expenses involved. Warranty replacement work must be scheduled in coordination with the client's academic/research schedule and may therefore require evening and/or weekend work.

PART 2 PRODUCTS

2.1 WOOD LABORATORY CASEWORK AND TABLES

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
- B. The contract for the work of this section must be held directly by one of the manufacturers named below.
1. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728 Tel: 800 711-LABS.
 2. CiF Lab Casework Solutions, 56 Edilcan Drive, Ontario, Canada L4K 3S6 Tel: 905 738-5821.
 3. Collegedale Casework, Inc., PO Box 810, Collegedale, TN 37315 Tel: 423 238-4131.
 4. Diversified Woodcrafts, Inc., 300 South Krueger Street, Suring, WI 54174 Tel: 920 842-2136.
 5. ISEC Wood Casework by S&H Cabinets, 33 Inverness Drive, Englewood, CO 80112 Tel 303 790-1444.
 6. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
 7. Mott Manufacturing Limited., 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825.
 8. Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121.
 9. Approved substitution.
- C. Quality Standards:
1. Wood casework shall comply with all requirements of AWS Custom Grade architectural cabinets, unless otherwise specified in this section.
 2. Wood casework shall comply with all requirements of SEFA 8-W, unless otherwise specified in this section.
- D. Design Requirements:
1. Door and drawer design: Square edged full flush overlay design with eased edges, 5/16 inch (8mm) top and bottom reveal and 5/32 inch (4mm) reveal horizontal and vertical and 1/16 inch (2mm) vertical reveal on ends of cabinets. Applied panels may be required in areas such as sink cabinets and knee spaces with pencil drawers to complete the flush construction.
 2. Pulls on doors shall be mounted vertically and on drawers horizontally.
 3. Grain Pattern:
 - a. Vertical Matched Grain Pattern: Grain pattern on all exposed surfaces shall be vertical. Entire front of each cabinet must be cut from a single panel.
 4. Toe Kicks/ Toe Spaces:
 - a. All tall storage cabinets to have toe space to match base units.
 - b. Provide toe spaces at all fully-exposed sides of cabinets, including locations such as the end of island benches, the end of peninsula benches, and outside-corner cabinets. Toe spaces shall run continuously through all items such as knee opening side panels and end panels.
 5. Full-Flush Construction and Installation: All finished panels and surfaces shall be in the same plane as the front of cabinet doors/drawers to provide a true flush overlay appearance.
 - a. Filler panels: Provide filler panels as needed where casework units meet perpendicular walls to create a continuous appearance.

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- b. Flush panels: Provide fixed fully-edgebanded flush panels at sink cabinets, knee opening drawer units, filler panels, and elsewhere, so that all finished panels are in the same plane as cabinet doors and drawers to provide a true flush overlay appearance.
 - c. Applied panels may be required in areas such as sink cabinets and knee spaces with pencil drawers to complete the flush construction.
 - d. At outside corners, align side panel of cabinet with the face of the door of adjacent cabinet.
 - e. At inside corners, mount filler panels flush with face of adjacent cabinet doors.
 - f. At open cabinets (without doors), align face of cabinet with face of adjacent cabinet door. Adjust the depth of the cabinet and toe kick accordingly.
 - g. Align other filler panels and applied panels with face of adjacent cabinet doors.
 - h. Align face of end panels and knee-opening side panels with face of adjacent cabinet doors.
 - i. Provide filler/ trim panels at locations where undercounter dishwashers or glasswashers are shown and the units provided do not completely fill the opening indicated.
6. Where cabinets are installed in an end-to-end configuration (for example, within a drywall alcove or across the complete width of a wall), adjust the width of at least one cabinet within the run so that filler panels at either end will not exceed two inches in width. Where knee openings are present, the knee opening width may be adjusted to meet this requirement.
 - a. At ends of island benches and peninsula benches, provide a paired set of base cabinets, each with an extended end, resulting in a single joint. These extended end panels shall be edgebanded on the front and bottom edges and shall meet at a hairline joint. Applied panels do not meet this requirement.
 7. Flush interiors: Set cupboard bottom flush with front-end facers. Surface mounted bottoms and offsets caused by front face frames that interfere with ease of cleaning are not acceptable.
 8. Non-exposed fasteners: Except where specifically shown or indicated, all fasteners used in the fabrication and installation of wood casework shall be hidden from view at all exposed and semi-exposed surfaces.
 9. Widths of drawer bodies in knee opening rails shall not be less than 18 inches (457 mm). As noted above, applied panel shall be provided to complete the flush construction on either side of the drawer head.
- E. Materials and Finishes:
1. Wood:
 - a. Definition of cabinet components by surface visibility:
 - 1). Exposed Surfaces:
 - a). Surfaces exposed when doors and drawers are closed.
 - b). Surfaces visible when behind glass doors, including tops and bottoms of shelves.
 - c). All exterior surfaces of suspended casework.
 - d). Open units.
 - e). Bottoms of cabinets if 42 inches (1070 mm) or more above finished floor.
 - f). Tops of cabinets if less than 72 inches (1830 mm) above finished floor.
 - g). Front rail of web frames.
 - 2). Semi-exposed surfaces:
 - a). Surfaces that are visible when solid (opaque) doors are open or drawers are extended, including backs of doors.

- b). Tops of cabinets 72 inches (1830 mm) or more above finished floor when visible from an upper level.
- 3). Unexposed surfaces:
 - a). Surfaces not normally visible after installation with doors open and drawers extended.
 - b). Bottoms of cabinets less than 30 inches (750 mm) above finished floor.
 - c). Tops of cabinets over 78 inches (1980 mm) above finished floor and not visible from an upper level.
- b. Wood Species and Veneer Cut: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
- c. Rift Sawn Oak
 - 1). Lumber:
 - a). Exposed and semi-exposed: Rift Sawn White Oak, wheat in color, NHLA Grade FAS.
 - b). Unexposed: Select grade hardwood of a species suitable for the specified purpose.
 - c). All lumber shall be clean and free of defects; kiln and air dried to uniform moisture content of 6 percent.
 - 2). Veneer:
 - a). Exposed: Rift Sawn Red Oak, grade A.
 - (1). Color and Matching:
 - (a). Maximum sapwood allowed: 5%.
 - (b). Color streaks or marks allowed.
 - (c). Slight color variation.
 - (d). No sharp contrast at veneer joints.
 - (2). Natural Characteristics:
 - (a). Small conspicuous burls and pin knots: combined average not to exceed 4 per 10 square feet (1 m²).
 - (b). Conspicuous burl size: 3/8 inch (9.5 mm), maximum.
 - (c). Pin knot size, dark part: 1/8 inch (3.2 mm), maximum.
 - (d). Pin knot size, total: 1/4 inch (6.4 mm), maximum.
 - (e). Slight cross bars allowed.
 - (3). Manufacturing Characteristics:
 - (a). Rough cut or ruptured grain is not allowed.
 - (b). Blended repaired tapering hairline Splits: two 1/16 inch (1.6 mm) x 6 inch (152 mm) on end panels only.
 - (c). Repairs: very small blending allowed.
 - (4). Veneer shall be hand selected for uniformity of color and grain prior to fabrication of cabinet faces. The resulting selection shall provide a pleasing uniform appearance and shall not allow darker and lighter panels in the same area or room after installation.
 - (5). Flitch Width, Face Components: 3 inches minimum, except for outside components.
 - b). Semi-Exposed: Rift Sawn White Oak, Grade B.
 - c). Unexposed: Any cut of hardwood veneer, grade 4 or better.

2. Plywood
 - a. Typical, Unless Otherwise Noted: Hardwood Veneer Plywood
 - 1). Product shall be provided with hardwood face veneers as specified above.
 - 2). Plies:
 - a). ¾ inch (19 mm): minimum 7-ply, including face veneers.
 - b). 1 inch (25 mm): minimum 9-ply, including face veneer.
 - 3). Physical Properties:
 - a). Screwholding: 355 lb at face.
 - b). Average modulus of rupture: 7346 psi (50.65 N/mm²).
 - b. Drawer and Door Fronts: ANSI A208.1 M3 Grade Industrial Particleboard Core Plywood.
 - 1). Product shall be provided with hardwood face veneers as specified above.
 - 2). Plies:
 - a). 3-ply, including face veneers.
 - 3). Physical Properties:
 - a). Screwholding: 250 lbs at face, 225 pounds at edge.
 - b). Average modulus of rupture: 2,400 lb/in².
 - c). Modulus of elasticity: 400,000 lb/in².
 - d). Hardness: 500 lbs.
 - c. Drawer box back, front and sides: Finnish or Baltic Birch Plywood
3. Hardboard: Dry process S2S hardboard made from compressed exploded wood fibers.
4. Edgeband/Facer: 1/8" (3 mm) hardwood; species as described above.
5. Dowels: 8 mm, diameter, minimum, hardwood, laterally fluted with chamfered ends.
6. Glue: Type 2 or Type 3 water resistant glue with gluing done in clamps and jigs.
7. Finish for Wood Laboratory Components:
 - a. Finish processes (stains and finishes) shall be by means of compression spray, providing high-transfer efficiency low waste generation. Solvent applied coatings are not acceptable and will not be considered. Manufacturer shall supply documentation that waste generated during the finishing process, is a non-hazardous material, eliminating liquid waste disposal in landfills.
 - 1). Chemically Resistance Finish: Finish for all wood products shall be environmentally friendly, highly chemically resistant, water-borne, laboratory-grade finish that satisfies the requirements specified herein for chemical and durability resistance. A letter from a third-party validator, verifying independent test results, shall be submitted.
 - 2). Operator Protection: The application shall be convenient and easily mastered, in a custom spray booth. The finish process shall be cleanly contained and shall have no solvent odor, and shall be applied in an air-conditioned room.
 - 3). VOC Emissions: Water-borne finishes shall be sprayed and cured with a near zero (2.0 lbs. per gallon for 'clean finish') VOC (Volatile Organic Compounds) emissions.
 - 4). Offgasing: After all wood products have cooled from the curing ovens, the coating shall be firm and stable. No further emissions or "Offgasing/Decomposition" vapors shall occur at room temperature.
 - b. Manufacturer may use either of the following finish systems:
 - 1). Customized, high-solids, cross-linked, ultraviolet light (UV)-cured coating developed for durability, including abrasion, chemical, impact, and scratch resistance, for flat-line applications. Coatings shall have little or no VOCs.

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- 2). Chemical-resistant modified acrylic urethane finish with built-in UV blocker, or equal, applied over permanent wood stain.
 - c. Stain Color:
 - 1). To be selected by Architect from manufacturer's full published color range.
 - d. Application:
 - 1). Finish application and sequence shall be as recommended and designed by the manufacturer for a high quality, laboratory-grade wood casework finish.
 - 2). Preparation: Sand exposed and semi-exposed surfaces smooth, free from dirt and defects.
 - 3). Stain application: Apply stain of color selected to all exposed and semi-exposed casework surfaces. Apply in a manner to achieve a match with the selected color sample upon completion of application of the finish.
 - 4). Finish application: Apply chemical resistant top finish to all stained surfaces. Apply to doors after any notching for hinges has been performed. Finished surfaces shall be even, water-clear and bright. Cloudy or muddy finishes carrying tinting pigments will not be acceptable.
 8. Glass: Framed glass doors:
 - a. 1/8 inch (3mm) to 7/32 inch (5.5 mm) nominal tempered glass.
 - b. Without imperfections or marred surfaces.
 - c. All glass should have etched safety information, readable from outside the cabinet.
- F. Construction:
1. Base Cabinets:
 - a. Assembly: Dowel and/or mortise-and-tenon joinery secured with countersunk screws and pressure-glued.
 - b. Cabinet Top:
 - 1). L-shaped front rail of 3/4" plywood: 1 1/2 inches (38 mm) x 2 1/4 inches (57 mm); or horizontal front rail of 1 inch (25 mm) x 3 inches (76 mm) hardwood. Back rail: 3/4" plywood or hardwood, 3-3/4" tall.
 - 2). At mobile cabinets (and other cabinets where tops are exposed): full 3/4" plywood top set inside cabinet sides and back, with exposed finish, grain running from front to back.
 - 3). Side panels and end panels: edgeband front edge and bottom edge.
 - c. Cabinet Backs, Exposed to View From the Inside at Open Units and Units with Glazed Doors: 1/4 inch (19 mm) thick veneer core plywood.
 - d. Cabinet Back, Semi-Exposed and Unexposed:
 - 1). Removable hardboard, 1/4 inch (6 mm) thick.
 - 2). Sink base back shall be half-height construction to allow for plumbing and sink waste connection.
 - 3). Provide split back on drawer cabinets.
 - e. Cabinet Base: 3/4 inches (95 mm) x 3/4 inch (19 mm) front hardwood or veneer core plywood toe space rail, mounted between end panels, forming a 4 inch (102 mm) high x 2 1/2 inch (63 mm) deep toe space, closed to cupboard bottom. Secure rails to cabinet end panels.
 - 1). If veneer core plywood option is used, edgeband bottom edge for moisture protection.
 - f. Shelves: 1 inch (25 mm) thick full depth, 9-ply hardwood plywood.
 - 1). All edges of removable shelves shall be edgebanded.

- 2). Retainer Rail: Retainer rail as specified elsewhere this section and detailed on drawings.
 - 3). Pull-Out Shelves: Construction shall be similar to drawer body mounted on a full-extension pull-out slide, with ½ inch (12mm) hardwood plywood bottom.
 - 4). Shelf Adjustment: All shelves shall be adjustable on 32 mm centers.
 - 5). Shelf Tolerance: Shelves shall fit into cabinets or into shelf supports with a tolerance of 1/16 inch per side maximum.
 - g. Drawer construction:
 - 1). Drawer box back, front and sides shall be of ½ inch (13 mm), 9-ply Finnish or Baltic Birch veneer plywood, with eased top edge, finished with a 7-level polyester acrylic finish. Sides shall be full height with 1 inch (25 mm) clearance to frame opening. Drawers shall be a minimum of 18 inches front to back.
 - 2). Acceptable drawer joinery options:
 - a). Dowel: Glued under pressure; 32mm, minimum, dowel spacing to 4 inches (102 mm) high, 64 mm dowel spacing above 4 inches (102 mm).
 - b). Lock Shoulder: Glued and pin nailed.
 - c). Multiple Dovetail: Tight fitting and glued.
 - 3). Drawer bottom shall be ¼ inch (6mm) white PVC-clad hardboard. Bottom shall be grooved into the 4 sided drawer box and sealed with hot melt glue process around entire drawer bottom perimeter. For drawers greater than 24 inches (600 mm) wide, provide galvanized metal hat channel support at centerline of drawer.
 - 4). Drawers up to 24 inches wide: 3/8 inch (6mm) thick 7-ply Baltic Birch veneer plywood.
 - 5). Drawers greater than 24 inches wide: 1/2 inch (13 mm) thick 9-Ply Baltic Birch veneer plywood.
 - h. Front Horizontal intermediate Rail: ¾ inch (19 mm) x 1½ inches (38 mm) exposed hardwood rail shall be provided between doors and drawers. For all drawer units at benches where service fitting connections are not accessible via an adjacent knee opening filler or cabinet filler panel, drawer units to be provided with Keku fasteners (Keku fasteners not required at other locations). The drawer unit intermediate horizontal and vertical box frames must be removable. These components shall be assembled with Keku suspension fittings as manufactured by Häfele America Co. or approved so these members are easily removable at any time with no special tools to gain access to concealed piped services behind.
 - i. Intermediate Back Rail: 1½ inch (38 mm) x ¾ inch (19 mm) hardwood lumber to accept hardboard security panel between drawers.
 - j. Security Panels: Provide hardboard security panels, 1/8 inch (3 mm) thick, in frames when keyed-different locks are specified, or where individual padlock hasps are indicated. Inset security panel into frame on all four sides.
2. Wall, upper and tall cases:
 - a. Shall be manufactured with materials and joinery methods as specified for base units, unless otherwise indicated.
 - b. Edgebanding:
 - 1). Wall cabinets: Fabricate underside of wall cabinets to comply with AWI type "B" flush configuration (refer to AWI 2005 Quality Standards). Edgeband front and top edges of all side and end panels.
 - 2). Edgeband front and top edges of upper cabinet side and end panels.
 - 3). Edgeband front and top edges of tall cabinet side and end panels.

- c. Cabinet Interior Backs: 1/4 inch thick veneer core plywood, typical for all exposed, and semi-exposed interior backs.
 - d. Hardwood plywood tops: 1 inch (25 mm) thick with front edge edgebanded.
 - e. Wall and upper case hardwood plywood bottoms: 1 inch (25 mm) thick. Tall case hardwood plywood bottoms 3/4 inch (19 mm) thick. Edgeband front edges.
 - f. Bottom hardwood kick rail on tall cases: 3/4 inches (95 mm) x 3/4 inch (19 mm) front hardwood or veneer core plywood toe space rail, mounted between end panels, forming a 4 inch (102 mm) high x 2 1/2 inch (63 mm) deep toe space, closed to cupboard bottom. Secure rails to cabinet end panels.
 - g. Solid doors shall be the same construction as specified for base cabinets.
 - h. Framed-glazed doors: Hardwood construction, 3/4 inch (19 mm) x 2 3/4 inch (70 mm) machined to accept glass. Ease all edges, interior and exterior, including those that frame the glazing. Provide extruded vinyl retaining molding on interior designed so glass can be replaced without tools
 - i. Shelves: 1 inch (25 mm) thick full depth, 9-ply hardwood plywood.
 - 1). All edges of removable shelves shall be edgebanded.
 - 2). Retainer Rail: Retainer rail as specified elsewhere in this section and detailed on drawings.
 - 3). Shelf adjustment:
 - 4). Wall units: All shelves shall be adjustable on 32 mm centers.
 - 5). General purpose tall units: One fixed shelf. All others shall be adjustable on 32 mm centers.
3. Wood-Framed Laboratory Tables
- a. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.
 - b. Electrical receptacles: Where indicated on the Laboratory Electrical drawings provide cutouts for electrical receptacles as work of this Section and coordinate with Division 26.
 - c. Cord and plug shall be provided under the work of Division 26.
 - d. Leveling Glide and Leg Shoe: Each leg other than those fitted with casters, shall have leveling glides and leg shoes.
 - 1). Leveling glides: (2 inch) (48 mm) diameter, two-piece pivot construction, steel housing, nonmarring, phenolic or translucent plastic insert, (1/2 inch) (12 mm) diameter, minimum (1 1/2 inch) (36 mm) long zinc plated stems. Each glide shall have a load bearing capacity of 150 lbs.
 - 2). Leg shoe: Black covered vinyl or rubber leg shoe, 2 inches (50 mm) in height.
 - e. Casters: Where indicated on Laboratory Furnishing drawings, provide sets of 3 1/2 inch (89 mm) diameter wheels with self-lubricating bearing, rated to carry 250 pounds (113 kg) minimum each. Each caster must swivel and have a locking brake at front wheels. Wheel shall be of molded polyurethane tread mechanically locked to a polyolefin core. Moveable tables to have all 4 swivel and locking casters.
 - f. Rails: Not less than 3/4 inch x 4-5/16 inch (19 x 110 mm) solid lumber with attached heavy duty steel corner braces, grooved and screwed into both rails at each corner. Groove rails for "Z" irons or drill for top attachment.
 - g. Reinforcing cross rails: Hardwood lumber doweled and glue into front and back rails and pinned at intervals not more than 33 inches (838 mm) on center in tables without drawers.
 - h. Legs: Not less than 2 inch x 2 inch (50 x 50 mm).
 - 1). Construction: Either of the following is acceptable:
 - a). Made of one solid piece of lumber

- b). Made from two pieces of solid lumber glued together. Individual components shall be carefully selected for color match. The glue joint shall be on the diagonal of the leg, as seen in plan. All legs shall be oriented so that the diagonals converge to create an “X” in plan.
- 2). Veneered lumber or wood of any type is not acceptable for leg components.
 - i. Leg rails and spreader rail: Not less than 1¼ inch x 2½ inch (32 x 63 mm) hardwood lumber.
 - j. All exposed edges of legs and rails shall be eased, sanded smooth, and finished per the requirements for wood laboratory casework components.
- 4. Aprons and leg assemblies:
 - a. Apron: Not less than ¾ inch (19 mm) x 4-5/16 inch (110 mm) hardwood.
 - b. Legs: Not less than 2 inch (50 mm) x 2 inch (50 mm) hardwood.
 - c. Leg rails: Not less than 1¼ inch (32 mm) x 2½ inch (63 mm) hardwood.
 - d. All exposed edges of legs and aprons shall be eased, sanded smooth, and finished per requirements described above for wood laboratory casework components.
- 5. Wood Casework Construction Performance:
 - a. Base cabinets shall be constructed to support a uniformly distributed load of 200 lbs. minimum per square foot (1000 kg/m²) of cabinet top area (total maximum of 2000 lbs. (900 kg)), including working surface, without permanent distortion or interference with door and drawer operation.
 - b. Base cabinets shall be constructed so that when supported on both back corners and one front corner; with a counterweight load of 350 pounds placed on the rear corner behind the supported front corner; and with a load of 200 pounds placed on the unsupported corner – there shall be no permanent damage after 24 hours of loading. Maximum allowable deflection shall not exceed 1/8 inch.
 - c. Swinging doors mounted on base units shall support a 250 lb. (113 kg) load located at a test point 12 inches (305 mm) measured horizontally from hinge along the top edge of door through a swing of 160 degrees. Weight test shall allow nominal temporary deflection, but no permanent distortion. Door assembly shall be twist-resistant and rigid, and shall close in a flat plane against the cabinet to permit the door catch at top of door to function properly.
 - d. Drawers shall be constructed so that they will support a 150 pound load hung on the drawer head centerline, with the drawer opened 13 inches (330mm), for five minutes. There shall be no interference with the normal operation of the drawer and the drawer head should remain tightly fastened to the drawer.
 - e. Drawers shall be constructed so that a drawer that is removed and supported on four corners will support a 10 pound sand or shot bag dropped from a height of 24 inches (610mm) without damage.
 - f. Drawers shall be constructed so that a drawer that is removed and supported at a 45 degree angle shall be capable of withstanding three impacts of a 2 inch (51mm) diameter, 12 inch (305mm) long steel rod (approximately 10 pounds in weight) released from 13 inches (330mm) from the front and back of the drawer. The drawer joinery shall remain intact and the drawer shall operate normally when placed back into the casework cabinet.
 - g. Drawers mechanical suspension systems shall be designed and attached to that a drawer uniformly loaded with 75 pounds of sand or shot bags shall operate freely without binding over its full range for 50,000 cycles at a rate not exceeding 10 cycles per minute. The force required to open and close the loaded drawer for the purposes of this test shall not exceed 8 pounds.

- h. Shelves shall be designed and supported to that they can support a load of 40 pounds per square foot, up to a maximum of 200 pounds per shelf, for 24 hours with no more than 0.35 inches (9mm) of deflection maximum.

G. Hardware: As specified elsewhere in this Section.

H. Wood Finish Performance Requirements:

1. Chemical resistance: Contractor shall provide verification of wood finish performance. Testing to be performed by independent testing agency.

a. Procedure: Finished panels shall be oriented horizontally and vertically during exposure to the test chemicals. Chemical concentrations shall be adjusted by the volume method. Ambient temperature and chemical temperature shall be 68°F to 72°F (20°C to 22°C). At the end of the test period, the surface shall be washed with detergent and warm water. Areas exposed to solvents shall be cleaned with a cloth dampened with the respective solvent. Prior to the evaluation, 16 - 24 hours after the chemicals have been removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

- 1). Horizontal Test: Apply five (5) drops of the acid, base or salt substance to the correspondingly numbered areas of the surface to be tested. Position a 1 inch (25.4 mm) diameter watch glass in the liquid, convex side downward. Solvents shall be applied by saturating a 1 inch (25 mm) ball of cotton, then covering with an inverted 2 ounce (56.7 g) wide-mouth bottle. Test duration shall be one hour.
- 2). Vertical Test: The test surface shall be marked to indicate divisions; 12 inches (305 mm) high, ¾ inch (19 mm) wide, and numbered to identify the chemicals. Five (5) drops of each substance shall be applied to its respective numbered area in a vertical track pattern to prevent crossover. Test duration shall be two hours.

b. Evaluation ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

c. Minimum acceptable results of chemical resistance test:

Reagent		Horizontal Test Rating	Vertical Test Rating
Acetic Acid	50%	1	1
Acetic Acid	75%	2	1
Hydrochloric Acid	20%	1	1
Hydrochloric Acid	37%	2	1
Hydrogen Peroxide	30%	1	1
Nitric Acid	10%	1	1
Nitric Acid	25%	2	2
Phosphoric Acid	50%	1	1
Phosphoric Acid	75%	1	1
Sulfuric Acid	25%	1	1

Reagent		Horizontal Test Rating	Vertical Test Rating
Sulfuric Acid	50%	2	1
Glycerin		1	1
Potassium Hydroxide	40%	1	2
Potassium Hydroxide	45%	1	2
Sodium Hydroxide	25%	1	1
Sodium Hydroxide	35%	1	1
Sodium Hydroxide	40%	1	1
Sodium Hydroxide	50%	1	1
Sodium Chloride	Saturated	1	1
Sodium Carbonate	Saturated	1	1
Sodium Hypochlorite	5.25%	1	1
Zinc Chloride	Saturated	1	1
Acetone	50%	2	1
Butyl Alcohol		1	1
Ethyl Acetate		2	1
Ethyl Alcohol		1	1
Ethyl Ether		2	1
Kerosene		1	1
Methyl Alcohol		1	1
Methyl Ethyl Ketone		2	1
Naphthalene		1	1
Toluene		2	1
Xylene		2	1

2.2 METAL LABORATORY CASEWORK, TABLES AND CASEWORK SYSTEMS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer. Corrosive and flammable liquid/solvent storage cabinets may also be provided by the manufacturers listed with their descriptions.
1. Laboratory Casework:
 - a. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728 Tel: 800 711-LABS.
 - b. Bedcolab Ltd, 2305 Francis Hughes Avenue, Laval, Quebec, Canada H7S 1H5 Tel 514 384-2820.
 - c. ISEC Laboratory Furniture and Equipment as Manufactured by Jamestown Metal Products, Inc., 178 Blackstone Avenue, Jamestown, NY 14701 Tel: 716 665-5313.
 - d. Jamestown Metal Products, Inc., 178 Blackstone Avenue, Jamestown, NY 14701 Tel: 716 665-5313.
 - e. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
 - f. Mott Manufacturing Limited., 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825
 - g. Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121.
 - h. Approved substitution.
 2. Corrosives and Flammable Liquid/Solvent Storage Cabinets:
 - a. Manufacturers of metal laboratory casework.

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- b. Eagle Manufacturing Company, 2400 Charles St., Wellsburg, WV 26070 Tel: 304 737-3171.
 - c. Justrite Manufacturing Company, 2454 Dempster St., Suite 300, Des Plaines, IL 60016 Tel: 800 798-9250.
 - d. Approved substitution.
- B. Metal Laboratory Casework
- 1. Quality Standards:
 - a. Metal casework shall comply with all requirements of SEFA 8-M, unless otherwise specified in this section.
 - 2. Door and Drawer Front Material and Design:
 - a. Square-edged flush front inset metal construction with all front surfaces above the toe space in the same plane.
 - b. Door and drawer design: Square edged full flush overlay design with 5/16 inch (8mm) top and bottom reveal and 5/32 inch (4mm) reveal horizontal and vertical and 1/16 inch (2mm) vertical reveal on ends of cabinets. Applied panels may be required in areas such as sink cabinets and knee spaces with pencil drawers to complete the flush construction.
 - c. Pulls on doors shall be mounted vertically and on drawers horizontally.
 - d. Non-exposed fasteners: Except where specifically shown or indicated, all fasteners used in the fabrication and installation of metal casework shall be hidden from view at all exposed and semi-exposed surfaces.
 - e. All tall cases shall be provided with toe space to match base units.
 - f. All cabinets shall be constructed and finished to be suitable for use as stand-alone units and to permit future rearrangement without the need for additional parts or finish.
 - g. Suspended casework: Provide as detailed on Laboratory Furnishing drawings. Construction of suspended casework units shall be the same as floor mounted cabinets with the following exceptions:
 - 1). Omit sub-base and provide casework with finished bottom panels.
 - 2). Fixings and fastenings necessary for its attachment to the supporting structure.
 - h. Widths of drawers in knee opening rails shall not be less than 24 inches (600 mm) or the width of the rail whichever is the lesser.
 - i. Cabinets below fume hoods that conflict with ductwork, cup sinks, or waste connections shall be 19 inches deep to accommodate any obstructions.
 - 3. Materials:
 - a. Steel: Cold-rolled furniture stock sheet steel, prime grade, roller leveled.
 - 1). Steel shall be treated at the mill to be free of scale, ragged edges, deep scratches, or other injurious effects.
 - 2). All gauges indicated are to be U.S. standard.
 - 4. Base, Wall, Upper, and Tall Cabinets:
 - a. General:
 - 1). Exterior corners: shall be spot and arc welded with heavy back up reinforcement at exterior corners. All face joints shall be arc welded and ground smooth to provide a continuous flat plane.
 - 2). All units shall have a cleanable smooth interior. Front and rear posts, reinforcing members or channel uprights shall be enclosed full heights on all cabinet openings.
 - 3). End Uprights shall be formed into not less than a channel formation at top, bottom, back and front.

- 4). The edge of the vertical uprights shall be formed to provide a strike for doors and drawers, and shall be perforated for the support of drawer channels, intermediate rails and hinge screws.
 - 5). An upright filler shall be screwed in place in all cupboard units to close the back of the channel at front of the upright and to provide a smooth interior for the cupboard to facilitate cleaning.
 - 6). The upright filler shall be perforated with shelf adjustment holes at no more than ½ inch (12.7 mm) centers.
 - 7). The inside front of the upright shall be further reinforced with a full height 14 gauge (2.0 mm thick) hinge reinforcement angle.
 - 8). Die Formed Gussets: shall be furnished in each bottom corner of base units to insure rigidity, and a 3/8 inch (10 mm) -16 leveling bolt, 3 inches (75 mm) long, shall engage a clinch nut in each gusset. Each leveling bolt and gusset shall be capable of supporting 500 lbs (225 kg). (Each unit shall support 2000 lbs. (900 kg) uniformly distributed on a work top.) Provide caps at all penetrations provided to access leveling devices.
- b. Cabinet Base:
- 1). Case bottom and bottom rail shall be formed of one piece of metal except in corner units and shall have both sides and back formed up or down and shall be offset in front to provide a door and drawer recess rabbet.
 - 2). Toe Space Rail: shall extend up and forward to engage bottom rail to form a smooth surfaced toe space, 3 inches (75 mm) deep and 4 inches (100 mm) high. Whenever the base is omitted for units to be set on building bases or separate metal bases, the toe space rail shall extend back 4½ inches (115 mm).
- c. Cabinet Back, Unexposed: Cabinet back shall consist of a top and bottom rail, channel formed for maximum strength and welded to back and top flange of end uprights, with space between left open for access to plumbing lines. All units shall be provided with removable back panels.
- d. Shelves: shall be full depth formed down ¾ inch (19 mm), back 7/8 inch (22 mm) and up ¼ inch (6 mm) at front and rear and formed down at ends ¾ inch (19 mm). Shelves over 36 inches (914 mm) in length shall be additionally reinforced by a flanged channel shaped member electro-welded to underside of shelf. Shelves shall be adjustable.
- 1). Restraint: At open shelf units, provide retainer rail as specified elsewhere in this section and detailed on drawings.
- e. Doors: shall be readily removable and hinges easily replaceable. Hinges shall be applied to the case and door with screws. Welding of hinges to either case or door will not be acceptable.
- f. Door and Drawer Heads:
- 1). Metal, Flush Inset: shall be a two-piece sheet steel assembly of ¾ inch (19 mm) overall thickness to consist of an inner pan formed as an extension of the drawer body, an outer pan having a channel formation on all four sides welded and ground to eliminate exposure of sharp raw edges, and the interior space filled with a non-organic sound deadening material at the time of assembly. Door Pans and Drawer Heads shall be painted inside and out prior to assembly.
- g. Drawer Construction:
- 1). Drawer bodies shall be made in one-piece construction including the bottom, two sides, back and inner front. They shall be fully coved at interior bottom on all four sides for easy cleaning. Sides shall be full

- height with ½ inch (13 mm) clearance to frame opening. Drawers shall be a minimum of 18 inches front to back.
- 2). Drawer Suspension: Refer to Drawer Slides under Hardware section.
 - 3). Drawer stops: shall be provided to insure smooth, quiet operation at point of contact with cabinet front.
- h. Top Horizontal Rail: Provide on base cabinets such that rail shall interlock within the flange at top of end panels for strength, but shall be flush at face of unit. Reinforcements shall be provided at all front corners for additional welded strength between vertical and horizontal case members.
 - i. Intermediate Rails: Provide on base cabinets such that rails shall be provided between doors and drawers, but shall not be provided between drawers unless made necessary by locks in drawers. When required, intermediate rails shall be recessed behind doors and drawer fronts, and designed so that security panels may be added as required.
 - j. Intermediate Vertical Uprights: shall be furnished to enclose cupboards when used in a unit in combination with a half width bank of drawers. However, to allow storage of large or bulky objects, no upright of any type shall be used at the center of double door cupboard units.
 - k. Security Panels: Provide security panels in frames between drawers and cabinets within a cabinet where keyed different locks are indicated.
 - l. Knee Space Service Strip Cover Panels where specified, shall be 18 gauge (1.3 mm thick) steel, of the same finish as cabinets, and shall be furnished at open spaces under counter top where no cabinets occur. They shall be easily removable and shall cover piping from underside of top of service ledge to floor.
 - m. Provide filler panels where required between cabinets, at corner intersections of cabinets, between cabinets and walls and wherever else required for a complete finished installation. For tall cabinets, filler panels shall be provided for vertical face and top. For wall cabinets, filler panels shall be provided for vertical face, top and bottom.
5. Aprons and leg assemblies:
- a. Apron: Not less than 1½ inch (38 mm) x 4 inch (114 mm) 16 gauge (x 1.6 mm thick) channel steel sections, reinforced as necessary for leg attachment.
 - b. Legs: Not less than 2 inch (50 mm) x 2 inch (50 mm) 16 gauge (x 1.6 mm thick) square tubular steel sections.
 - c. Leg rails: Not less than 1¼ inch (32 mm) x 2½ inch (63 mm) 16 gauge (x 1.6 mm thick) steel sections, reinforced as necessary for leg attachment. Each leg shall have a recessed leveling screw and a black, coved vinyl or rubber leg shoe, 2 inches (50 mm) in height.
6. Fume Hood Cabinets:
- a. Purpose-designed metal cabinet with fixed panel above door to conceal cup sink and plumbing.
 - b. Provide metal fume hood cabinets where adjacent cabinetry below a fume hood is also metal.
7. Corrosives Storage Cabinets:
- a. Purpose-designed lined metal cabinet.
 - b. Lining: Cabinet shall be complete lined with a polypropylene or polyethylene liner with sealed or seamless intersections between panels. No metal of any type shall be exposed within the lined interior of the cabinet. Screw-heads, if required, shall be covered with hinged-type (not snap-on) plastic screw-head covers.
 - 1). Shelf: Removable full-depth polypropylene or polyethylene shelf.
 - c. Label: "CORROSIVES" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match the Flammable

- Liquid/Solvent Storage Cabinet label. Lettering shall be 2 ½ inches tall. Color of lettering shall be red. If cabinet color is red, lettering shall be yellow.
- d. Locks: Cabinet doors shall be lockable.
 - e. Venting:
 - 1). Cabinets below or adjacent to fume hoods: Provide and install 2 inch (50 mm) diameter schedule 40 PVC vent pipe and PVC fittings. Termination of vent pipe maybe one of the following:
 - a). Extend vent pipe 4 inches (100 mm) above dished worktop, behind the baffle in the hood, as shown on the drawings. Provide hole through fume hood work surface above the corrosive storage cabinet to accommodate 2 inch (50 mm) diameter vent pipe. Seal gap around penetration with clear silicone sealant.
 - b). Extend vent pipe up within the fume hood side wall and vent through the hood side wall liner behind the upper portion of the fume hood baffle.
 - 2). Cabinets not below or adjacent to fume hoods: Vent connection to exhaust duct system shall be by Division 23. Provide hole in back of cabinet to accept exhaust connection.
 - f. Seismic Anchor: Provide seismic anchor for freestanding cabinets and cabinets located below fume hoods designated to be removable for access for persons with disabilities. Seismic anchors may be floor or wall attachments, but shall not attach to adjacent casework or work surfaces. Seismic anchors shall be accessible without removal of laboratory casework, furnishings, or equipment.
8. Flammable Liquid/Solvent Storage Cabinets:
- a. Purpose-designed double-walled metal cabinet for the storage of flammable, combustible and solvent liquids.
 - b. Cabinet doors: Well-fitting, metal, self-closing and self-latching with fusible lead links and door sequencer.
 - c. Label: "FLAMMABLE - KEEP FIRE AWAY" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match that of the Corrosive Storage Cabinet label. "FLAMMABLE" lettering shall be 2 ½ inches tall. "KEEP FIRE AWAY" lettering shall be 2 inches tall. Color of lettering shall be red. If cabinet color is red, lettering shall be yellow.
 - d. Locks: Cabinet doors shall be lockable.
 - e. Floor pan: Provide a 2 inch (50 mm) deep liquid tight pan to cover the entire bottom of the cabinet to contain liquid leaks and spills.
 - f. Shelves: Provide heavy-duty shelves with reinforced edges and underside.
 - g. Casters: Provide cabinets with lockable casters where indicated on the Laboratory Furnishing drawings.
 - h. Standards:
 - 1). Comply with the requirements of OSHA and NFPA 30.
 - 2). Comply with the requirements of Uniform Fire Code with UL 1275 and FM 6050 labels.
 - i. Flammable liquid/solvent storage (base) cabinets shall not be vented. Seal vent openings with bungs as provided by manufacturer.
 - j. Venting of tall cabinets:
 - 1). Remove both metal bungs from cabinet outlets and replace with flash arrestors provided by manufacturer. Connection with 2 inch (50 mm) black iron vent piping to the HVAC systems as shown on LF drawings shall be by Division 23.
 - 2). Vents from multiple cabinets shall not be manifolded prior to connection to the building system.

- k. Electrical grounding:
 - 1). Provide each flammable liquid / solvent storage cabinet with an externally mounted grounding conductor screw terminal for up to #8 AWG conductor, mounted at the top of the cabinet.
 - 2). Connection from the equipment grounding bus at the lab branch circuit panel to the storage cabinet terminal shall be by Division 26.
 - l. Seismic Anchor: Provide seismic anchor for freestanding cabinets and cabinets located below fume hoods designated to be removable for access for persons with disabilities. Seismic anchors may be floor or wall attachments, but shall not attach to adjacent casework or work surfaces. Seismic anchors shall be accessible without removal of laboratory casework, furnishings, or equipment. Anchor attachment shall not void UL listing.
9. Vacuum Pump Cabinets:
- a. Provide metal vacuum pump cabinets at:
 - 1). Locations where vacuum pump cabinets are located below fume hoods, and adjacent cabinets below fume hoods are also metal.
 - 2). At other locations where adjacent cabinets are metal.
 - b. Label: "VACUUM PUMP" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match the Flammable Liquid/Solvent Storage Cabinet lettering. Lettering shall be 2 ½ inches tall. Color of lettering shall be red. If cabinet color is red, lettering shall be yellow.
 - c. Venting: Exhaust connection will be by mechanical contractor. Provide flange for interface with exhaust duct.
 - d. Acoustical Lining: Cabinet shall be provided with sound absorption and thermal heat reflecting quilted liner on door back, interior cabinet top, and interior cabinet sides, and interior cabinet back.
 - 1). Acoustical Solutions product ABBC-13, no known equal.
 - 2). Attach along perimeter at 6" on center, typical.
 - e. Cable/ vacuum line through port: Provide as specified elsewhere in this section.
 - f. Pump Support: Pull out stainless-steel tray with fully welded corners on 150-pound full-extension drawer slides.
 - g. Pump Tray: Watertight polypropylene pan insert with chemically welded joints. Provide vibration isolating single-stick rubber tape on bottom of tray to isolate vibration transfer to the pull-out stainless-steel tray.
 - h. Electrical: Provide NEMA 5-20R receptacle mounted to inside back of cabinet installed by Division 11 with final connection by Division 26.
 - 1). Provide lit switch on fascia panel on front of cabinet to control receptacle.
10. Metal Casework Construction Performance: Base cabinets shall be constructed to support a uniformly distributed load of 200 lbs. minimum per square foot (1000 kg/m²) of cabinet top area (total maximum of 2000 lbs. (900 kg)), including working surface without objectionable distortion or interference with door and drawer operation.
- a. Base cabinet corner gussets with leveling bolts shall support 500 lbs. (225 kg) per corner, at 1½ inch (38 mm) projection of the leveling bolt below the gusset.
 - b. Each adjustable and fixed shelf 4 feet (1219 mm) or shorter in length shall support an evenly distributed load of 40 lbs. per square foot (200 kgf/m²) up to a maximum of 200 lbs. (90 kg), with nominal temporary deflection, but no permanent set.
 - c. Drawer assemblies shall automatically maintain alignment in cabinet opening and shall not bind during opening or closing of the drawer so as to minimize glass breakage and damage to fragile parts.
 - d. Swinging doors mounted on base units shall support a 250 lb. (113 kg) load located at a test point 14 inches (356 mm) measured horizontally from hinge

along the top edge of door through a swing of 180 degrees. Weight test shall allow nominal temporary deflection, but no permanent distortion. Door assembly shall be twist-resistant and rigid, and shall close in a flat plane against the cabinet to permit the door catch at top of door to function properly.

- C. Hardware: As specified elsewhere in this Section.
- D. Metal Casework Color: As selected by the Architect from manufacturer's full color line and complying with finish requirements described below.
- E. Metal Casework Finish Requirements:
 - 1. Paint finish for steel laboratory products shall utilize a dry coating process with minimal waste generation. Liquid-applied coatings shall not be acceptable. Manufacturer shall supply documentation that waste generated during the painting process, is a solid, non-hazardous material.
 - a. Pretreatment: Finish process shall incorporate a phosphate conversion coating during the pretreatment/cleaning operation.
 - b. Operator Protection: The painting process shall be cleanly contained, have no solvent odor and be performed in an air-conditioned room.
 - c. VOC (Volatile Organic Compounds) emissions shall not exceed 0.29 lbs per gallon (35 g/L).
 - d. Offgasing: No further emissions or "Offgasing/Decomposition" vapors shall occur at room temperature from installed finished parts.
 - 2. Preparation: After the units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish to the metal and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a heated cleaner/phosphate solution and pretreated with iron phosphate spray followed by a neutral final seal prior to application of final finish. The strength of each solution shall be monitored by filtration to insure consistent quality. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.
 - 3. Application: Electrostatically apply powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:
 - a. All surfaces, exterior or interior, exposed to view, shall receive sufficient powder coat to achieve an average 1.5 mil (38 μ m) film thickness with a minimum 1.2 mil (30 μ m) film thickness and shall have smooth satin luster.
 - b. Backs of cabinets and other surfaces not exposed to view shall have sufficient powder coat to achieve an average 1.0 mil (25 μ m) film thickness.
 - 4. All drawer bodies to be finished in matching color.
 - 5. Concealed interior parts shall receive corrosion-resistant treatment.
 - 6. Finish must be UV stable.
- F. Chemical Spot Test Performance Requirements:
 - 1. Chemical resistance: Contractor shall provide verification of metal finish performance. Testing to be performed by independent testing agency.
 - 2. Test procedure: A clean, dry, test panel shall be laid flat and level on a horizontal surface. Ambient temperature of 70°F to 76°F (20°C to 22°C) and relative humidity of 45% to 55% shall be maintained for 48 hours. After a test period of one hour, chemicals shall be flushed away with cold water and the surface washed with warm water, detergent, and

naphtha and rinse with deionized water. Dry with towel and evaluate after 24 hours, maintaining ambient conditions. Test using one of the following methods:

- a. Place a reagent-saturated cotton ball in the mouth of a one ounce (30 cc) bottle and inverting the bottle on the surface of the panel.
- b. Chemical spot tests shall be made by applying 5 drops (approximately 0.5 mL) of reagent to the surface to be tested, covered with a 24 mm watchglass, convex side down.

3. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	Slight surface etching or severe staining.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, swelling or erosion of the surface. Obvious and significant deterioration.

4. Minimum acceptable results of chemical resistance test:

Reagent	% by wt.	Rating
Acetic acid	98%	0
Acetone		0
Acid dichromate	5%	0
Ammonium hydroxide	28%	0
Amyl acetate		0
Benzene		0
Butyl alcohol		0
Carbon tetrachloride		0
Chloroform		0
Chromic acid	60%	0
Cresol		0
Dichloroacetic acid		1
Dimethylformamide		0
Dioxane		0
Ethyl acetate		0
Ethyl alcohol		0
Ethyl ether		0
Formaldehyde	37%	0
Formic acid	90%	0
Furfural		0
Gasoline		0
Hydrochloric acid	37%	0
Hydrochloric acid	48%	1
Hydrogen peroxide	3%	0
Methyl alcohol		0
Methyl ethyl ketone		0
Methylene chloride		0
Mono chlorobenzene		0
Naphthalene		0
Nitric acid	20%	0
Nitric acid	30%	0
Nitric acid	70%	1

Phenol	90%	0
Phosphoric acid	85%	0
Silver nitrate, saturated		0
Sodium hydroxide	10%	0
Sodium hydroxide	20%	0
Sodium hydroxide	40%	0
Sodium hydroxide, flake		0
Sodium hydroxide, saturated		0
Sulfuric acid	33%	0
Sulfuric acid	77%	0
Sulfuric acid/Nitric acid, equal parts	77%/70%	1
Tincture of Iodine		2
Toulene		0
Trichloroethylene		0
Xylene		0
Zinc chloride, saturated		0

- G. Hot Water Test
1. Test Procedure: 190°F to 205°F (88°C to 96°C) hot water shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.5 cc) per minute) on the finished surface, which shall be set at an angle of 45°, for a period of 5 minutes.
 2. Acceptance Level: After cooling and wiping dry, the finish shall show no visible effect from the hot water.
- H. Paint Adhesion on Steel Test
1. Test Procedure: Test shall be based on ASTM D2197-86 “Standard Method of Test for Adhesion of Organic Coating.” Two sets of eleven parallel lines 1/16 inch (1.587 mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid to 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush surface lightly with a soft brush for one minute. Examine under 100 fc (1076 lux) of illumination.
 2. Acceptance Level: Ninety or more of the squares shall show finish intact.
- I. Impact Test
1. Test Procedure: Drop a 1 lb (0.4536 kg) ball (approximately 2 inch (50.8 mm) diameter from a distance of 12 inches (305 mm) onto a flat horizontal surface, coated to manufacturer’s standard manufacturing method.
 2. Acceptance Level: No visual evidence to the naked eye of cracks in the finish due to impact.
- J. Paint Hardness on Steel Test
1. Test Procedure: Paint film shall be tested with pencils of various hardnesses. Pencils shall have a wide, sharp edge. Pencils shall be pushed across surface in a chisel-like manner.
 2. Acceptance Level: Finish film shall not rupture from a sharpened 4H pencil.

2.3 CABINET HARDWARE

- A. General: Special cabinets, such as corrosives storage, flammable liquid and solvent storage, rock storage, map storage, museum storage, radioisotope storage, and narcotics lockers, may be provided with the manufacturer’s standard hardware.
1. All door and drawer pulls shall match, regardless of type of casework, except for:
 - a. Polypropylene casework. Refer to the pull requirements as specified above.

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- b. Flammable liquid/ solvent storage cabinets, which should use manufacturer's standard latch handles as required to satisfy requirements of regulatory approvals.
 2. All hardware shall be compliant with the ADA Standards for Accessible Design (28 CFR Part 36).
 - B. Drawer and Hinger Door Pulls:
 1. Drawer and door pulls shall attach to door or drawer with machine screws. Two (2) pulls shall be furnished on drawers wider than 28 inches (711 mm). Plastic pulls or other types subject to breakage are not acceptable.
 2. Type: Pulls shall be round "wire."
 - a. Material and Finish:
 - 1). Stainless steel with finish as follows:
 - a). BHMA 630 Satin (Previously US32D).
 - b. Size:
 - 1). Length: 4 inches (100 mm) center to center of screw holes.
 - 2). Diameter: ¼ inch (6 mm).
 3. Pull: Manufacturer and model number. No substitutions.
 - a. Material and Finish:
 - 1). Material.
 - 2). Finish.
 - b. Length: Length.
 - C. Hinges:
 1. General: Hinges shall be attached to both door and case with three screws through each leaf. Provide two hinges for doors up to 48 inches (1219 mm) high; three hinges for doors over 48 inches (1219 mm) high.
 2. Type: Institutional with a five-knuckle bullet-type barrel. Characteristics:
 - a. Height: 2½ inches (63 mm), nominal.
 - b. Material:
 - 1). Stainless steel with stainless steel screws.
 - a). Finish:
 - (1). BHMA 630 Satin (Previously US32D).
 - b). Manufacturers:
 - (1). Rockford Process Control, Inc. 202 Seventh St., Rockford, IL 61104 Tel: 815 966-2000.
 - (2). Approved substitution.
 - D. Shelf Hardware:
 1. Shelf Supports:
 - a. Adjustable shelf supports: Adjustable plastic shelf support with lockdown clips for slotted standard.
 2. Manufacturers:
 - a. Bainbridge Manufacturing, Inc., P. O. Box 487, 237 W 3rd, Waterville, WA 98858 Tel: 800 255-4702.
 - b. The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501 Tel: 313 767-2050.
 - c. Knappe & Vogt Manufacturing CO., 2700 Oak Industrial Dr. NE, Grand Rapids, MI 49505 Tel: 616 459-7620.
 - d. Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746 Tel: 310 329-6373.
 - e. Approved substitution.

- E. Catches:
1. Roller Catches:
 - a. Materials: Roller catches shall be chrome-plated or zinc-plated steel with adjustable tension ball catch. Plastic type catches are not acceptable.
 - b. Application: Provide roller catches at top of all non-locked cabinet doors.
 - c. Manufacturers:
 - 1). The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501 Tel: 313 767-2050.
 - 2). Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746 Tel: 310 329-6373.
 - 3). Approved substitution.
 2. Elbow catches: Heavy-duty, adjustable, spring-type elbow catch and strike plate.
 - a. Material: Brass or steel with bright chromium plated finish.
 - b. Application: Elbow catches shall be used on left hand doors of locked double door cabinets, including tall cabinets.
 - 1). At tall cabinets, elbow catch shall latch to fixed center shelf. Latching devices using chains or strings are not acceptable.
 - c. Manufacturers:
 - 1). The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501 Tel: 313 767-2050.
 - 2). Approved substitution.
- F. Drawer slides:
1. Typical: Ball bearing slides:
 - a. Material:
 - 1). Clear, zinc-coated steel.
 - b. Full extension, 100 lb/pr. (45 kg/pr.) capacity: Accuride 3832, or equal.
 - c. File drawers shall be equipped with rail mounted with overtravel, 150 lb/pr. (68 kg/pr.) capacity: Accuride 4034, or equal.
 - d. Manufacturers:
 - 1). Accuride, 12311 Shoemaker Ave., Santa Fe Springs, CA 90670 Tel: 562 903-0200.
 - 2). Hettich America LLP, 6225 Shiloh Road, Alpharetta, Georgia 30005 Tel: 770 887-3733.
 - 3). Fulterer USA, 542 Townsend Ave., High Point, NC 27263 Tel: 800 395-4646.
 - 4). Waterloo Furniture Components Inc., 501 Manitou Dr., Kitchener, Ontario, Canada N2C 1L2 Tel: 519 748-5060.
 - 5). Approved substitution.
- G. Drawer Stops: All regular drawers shall be equipped with integral stops to prevent drawer head impact with cabinet body.
- H. Door Stops: Provide door stops for any cabinet door, which will strike an obstruction when opened between 90° and 135°.
1. Stop to be either:
 - a. Sash chain, #30 zinc-plated steel.
 - 1). Terminations: Zinc chromate wire screw eyes. Open eye as required to attach stop with screws. Through-bolting not allowed.
 - b. Coated cable.
 - 1). Seven-strand, 7-wire-per-strand, stainless steel cable with clear nylon coating.
 - 2). Wire diameter: 0.047 inches.

- 3). Composite diameter with coating: 0.063 inches.
 - 4). Terminations: Number 10 stake eye on both ends. Attach to door/cabinet with screws. Through-bolting not allowed.
 - 5). McMaster Carr part number 30345T3 or equivalent.
2. Engineer stop to length to allow door to open 1 ½ inch (40 mm) from obstruction.
- I. Locks:
1. General: Provide locks on all file cabinet drawers. Provide locks at other locations as indicated on the drawings. Provide chain bolts 3 inches (75 mm) long, with an 18 inch (450 mm) pull and an angle strike to secure inactive door on cabinets over 72 inches (1829 mm) in height. Five (5) or eight (8) tumbler locks are acceptable. Locks shall have satin nickel or satin chrome finish.
 2. Keying:
 - a. Each named laboratory group to be keyed alike, see plans.
 3. Key engraving:
 - a. Keys to be engraved with an identification number corresponding to the layout of unique keys on the project. All identical keys shall be engraved with the same number.
 - b. At laboratories with multiple, individually-locked drawers where number plates are indicated, engrave each key with number to match the number plate on each drawer.
 4. Framed sliding door locks shall be plunger type.
 5. Manufacturers:
 - a. Swinging Doors and Drawers:
 - 1). National Cabinet Lock, 200 Old Mill Rd., P. O. Box 200, Mauldin, South Carolina 29662 Tel: 864-297-6655.
 - 2). Illinois Lock Company, 301 West Hintz Rd., Wheeling, IL 60090 Tel: 847 537-1800.
 - 3). Approved substitution.
 - b. Sliding Doors:
 - 1). National Cabinet Lock, 200 Old Mill Rd., P. O. Box 200, Mauldin, South Carolina 29662 Tel: 864-297-6655.
 - 2). Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746 Tel: 310 329-6373.
 - 3). The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501 Tel: 313 767-2050.
 - 4). Approved substitution.
- J. Glides: Non-marring material, 1 inch (25 mm) diameter, minimum, with at least 5/8 (16 mm) vertical adjustment. Provide on movable tables, unless otherwise indicated.
- K. Leveling devices: Provide each table leg with 3/8 inch (10 mm) minimum diameter leveling bolt and floor clip.
- L. Leg shoes: Leg shoes shall be provided on all legs and table legs to conceal leveling devices, except for tables with casters. Shoes shall be 2 ½ (63 mm) inch high and of black rubber or pliable black vinyl material. Use of a leg shoe which does not conceal leveling device is not acceptable.
- M. Floor clips: Provide leg assemblies and fixed table legs with floor clips securely fastened to the floor after shimming.
- N. Casters: Where indicated on Laboratory Furnishing drawings, provide sets of 3 ½ inch (89 mm) diameter wheels with self-lubricating bearing, rated to carry 250 pounds (113 kg) minimum each.

Each caster must swivel and have a locking brake. Wheel shall be of molded polyurethane tread mechanically locked to a polyolefin core.

1. Material: Caster shall be heavy gauge cold rolled steel with bright zinc plating.
 2. Manufacturers:
 - a. Acorn Industrial Products Co., 7 Union Hill Dr., W. Conshohocken, PA 19428
Tel: 800 523-5474.
 - b. Caster Technology Corporation, 3265 Whipple Rd., Union City, CA 94587, Tel:
510 429-6727.
 - c. Hamilton Caster & Mfg. Co., 1637 Dixie Highway, Hamilton, OH 45011 Tel:
888 699-7164.
 - d. Approved substitution.
- O. Support Struts and Service Ledging: Refer to specifications for slotted channel framing in this Section.
- P. Cord Management Hook: At movable tables, as shown on drawings, provide two cord management hooks at each table. McMaster Carr type 304 stainless-steel hook, part number 19075A12, or equivalent, with matching mounting screws.

2.4 LABORATORY WORK SURFACES

- A. Applicable Standards:
1. Laboratory Work Surfaces shall comply with all applicable requirements of SEFA 3, unless otherwise specified in this section.
- B. Epoxy Resin:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
 - a. Durcon Laboratory Tops, Inc., 206 Allison Drive, Taylor, TX 76574 Tel: 512-595-8000.
 - b. Epoxyn Products, 500 E. 16th Street, Mountain Home, AR 72653
Tel: 870 425-4321.
 - c. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687
Tel: 704 873-7202.
 - d. Prime Industries, Inc., 2600 Warrenville Road, Suite 205, Downers Grove, IL 60515 Tel 630-725-9200
 - e. Approved substitution.
 2. Thickness:
 - a. Typical work surface: 1 inch (25 mm).
 - b. Fume hood work surfaces: Tops shall be 1¼ (32 mm) inches thick at outer edge, indented ¼ inch (6 mm) to provide a raised rim around all exposed edges 1 inch (25 mm) wide, minimum, or as to allow for the fume hood sash. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded or chamfered to a 1/8 inch (3 mm) radius. The juncture between the raised rim and the top surface shall be coved or chamfered to a ¼ inch (6 mm) radius.
 - c. Curbs and Splashes: 1 inch (25 mm).
 3. Color:
 - a. Black.
 - b. Color sample to be approved by Architect before work is put in hand.
 4. Description:
 - a. Monolithic filled epoxy resin work surface consisting of a polymerized cast resin material oven-cured in molds.

- b. Drip Grooves: Provide under all work surface exposed edges, unless noted otherwise on the Laboratory Furnishing Drawings. Drip grooves shall be ½ inch (13 mm) from the front edge where the top overhangs 1 inch (25 mm) and ¼ inch (6 mm) from the edge where the edge overhangs ½ inch (13 mm).
- c. Edge profile: For all exposed upper edges and corners:
1). Bevel eased: 1/8 inch (3 mm) machined bevel with blended radius corners.
- d. Marine edges: Where indicated on the Laboratory Furnishing Drawings, shall be 1 inch (25 mm) wide and ¼ inch (6 mm) high with chamfered or radiused transition to and be an integral part of the work surface.
- e. Indented areas: Where indicated on the Laboratory Furnishing Drawings, shall be ¼ inch (6 mm) deep with chamfered or radiused sides. Internal and external corners shall have ¼ inch to ½ inch (6 to 13 mm) radius. Marine edges formed around indented areas shall not be less than 1 inch (25 mm) wide.
- f. Drain grooves: Where indicated on the Laboratory Furnishing Drawings, shall be 3/8 inch (9mm) wide, 2 inches (50mm) on-center, and shall slope at 1/8 inch (3mm) per foot towards the sink.
- g. Raised rib drain board: Where indicated on the Laboratory Furnishing Drawings, provide ¼ inch (6mm) high, ¼ inch (6mm) wide raised radiused ribs at ¾ inch (18mm) on center. Slope worksurface to sink at 1/8 inch (3mm) per foot.
- h. Sink Mounting:
1). Drop-in Sink: Cutouts shall be profiled to provide support for the sink, and to ensure that the rim of the installed sink is 1/8 inch (3 mm) below the surrounding work surface level or bottom of drain grooves, if present. The top edge of the cutout shall have 1/8 inch (3 mm) bevel. Ensure that there shall be no gaps between the installed sink rim and work surface. Cement sinks in place with epoxy rein cement.
- i. Curbs and Splashes:
1). Height: 4 inches (100 mm), unless noted otherwise on Laboratory Furnishing Drawings.
2). Bonded to the surface of the top to form a square joint.
- j. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Verify size of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 inch (3 mm). After sawing, rout and file cutouts to ensure smooth, crack-free edges. Polish exposed edges to match finish of worksurface.
5. Physical Properties:
a. Chemical resistance:
1). Organic solvents: A cotton ball, saturated with the test chemical, is placed in a one ounce bottle with a reservoir of liquid above the ball. The container is inverted on the test material surface for a period of 24 hours. Test temperature: 23°C ±2°C.
2). Other test chemicals: Five drops (1/4 cc) of the test chemical are placed on the test material surface. The chemical is covered with a 1 inch diameter watch glass for a period of 24 hours. Test temperature: 23°C ±2°C.
3). Evaluation: After 24 hours exposure, exposed areas are washed with water, then a detergent solution, finally with naphtha, then rinsed with distilled water, dried with a cloth, and rated as follows:
- | | | |
|---|-----------|--|
| 0 | No effect | No detectable change in the material surface. |
| 1 | Excellent | Slight detectable change in color or gloss but no change in function or life of the surface. |

2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

4). Test results:

Test chemical	Concentration	Black	Dark gray	Light gray	Beige
Chromic acid	40%	3	2	2	2
Hydrochloric acid	10%	0	0	0	0
Hydrochloric acid (conc.)	37%	0	0	0	0
Nitric acid	40%	0	0	0	0
Nitric acid (conc.)	70%	0	0	0	0
Sulfuric acid	60%	0	0	0	0
Sulfuric acid (conc.)	96%	4	4	4	4
Acetic acid	5%	0	0	0	0
Acetic acid (glacial)		0	0	0	0
Citric acid	1%	0	0	0	0
Oleic acid		0	0	0	0
Phenol solution	5%	0	0	0	0
Ammonium hydroxide	10%	0	0	0	0
Sodium carbonate sol.	20%	0	0	0	0
Sodium hydroxide sol.	60%	0	0	0	0
Sodium hypochlorite sol.	4%	0	0	0	0
Acetone		1	1	1	1
Benzene		1	1	1	1
Carbon tetrachloride		1	1	0	0
Diethyl ether		0	0	1	1
Dimethyl formamide		0	0	0	0
Ethyl acetate		0	1	1	0
Ethyl alcohol	95%	0	0	0	0
Ethylene dichloride		0	0	0	0
Heptane		0	0	1	0
Isooctane		0	0	0	0
Kerosene		0	0	0	0
Methyl alcohol		0	0	0	0
Toluene		0	0	0	0
Aniline		0	0	0	0
Mineral oil		0	0	0	0
Olive oil		0	0	0	0
Soap solution	1%	0	0	0	0
Transformer oil		0	0	0	0
Turpentine		0	0	0	0

- b. Heat resistance:
- 1). High temperature test: A porcelain crucible is heated to a dull red color, placed on the test material, and allowed to cool to ambient temperature. Result: No observable surface deformation.
 - 2). Flame test: A 3/8 inch (10 mm) Bunsen burner is adjusted to a quiet flame with a 1½ inch (38 mm) inner cone, overturned on the test material, and allowed to stay for 5 minutes. Result: no observable surface deformation.

c. Physical properties:

Compressive strength	ASTM D695	31,400 psi (216 MPa)
Tensile strength	ASTM D638	8,000 psi (55 MPa)
Flexural strength	ASTM D790	11,700 psi (81 MPa)
Rockwell hardness "M"	ASTM D785	105-110
Specific density	ASTM D792	122.4 lb/ft ³ (1960 kg/m ³)
Water absorption	ASTM D570	0.01%
Fire Resistance	ASTM D635	ATB (sec)=0
Heat deflection @ 264 psi (1.82 MPa)	ASTM D648	342°F (172°C)

- C. Solid Laminated Wood: Edge grain maple of 1¾ inch (44 mm) thickness with edge grain exposed. Composed of solid hard maple strips 1¾ inches (44 mm) wide, glued with water-resistant resin under heavy pressure side to side and end to end. Curbs and splashes to be ¾ inch (18mm) thick matching material, 4 inches (100mm) high. Round top edges and corners and sand smooth. Finish with three coats of moisture and chemical resistant natural varnish applied to all surfaces and edges fine sand between coats.

2.5 MOBILE WORKSTATION

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
1. Fisher Hamilton, L.L.C., 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121.
 2. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
 3. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728 Tel: 800 711-LABS.
 4. Approved substitution.
- B. Components
1. General requirements for tables:
 - a. Vertical structural support: 11-gauge cold rolled vertical shall integrate five cable management grommets, in each vertical, for ease running cabling.
 - b. Equipment rack base: 7-gauge cold rolled horizontal base shall incorporate four bi-directional casters and four levelers that enables the end-user to extended the leveler support foot to prevent any movement from equipment or personnel.
 - c. Table/shelf support frame: 11-gauge cold rolled steel tubing. Cabinet support channels: 14 gauge cold rolled steel. Weld members using the inert gas process.
 - d. Support arms:
 - e. Cantilever support arms: 11 gauge cold rolled steel.
 - f. Lower shelf support: 11 gauge rolled steel.
 - g. Cable Management Grommets: Flame resistant ABS plastic, color is black.
 - h. Finish: Chemical resistant powder paint color to be Fisher Hamilton 1388, SA Sand or equal.

2. Cantilever Table/Shelf Frame:
 - a. Nominal table frame dimensions:
 - 1). Width: Varies – see plans
 - 2). Depth: 29 inches
 - 3). Height: 6'-6"
 - b. Capable of vertical adjustment in one-inch increments.
 - c. Support arm bracket: Support frame of 11 gauge cold rolled steel that incorporates four mechanically fastened machine bolts that interlock into a machine threaded welded lock nut.
 - d. Cantilever table frame shall provide support channels from which suspended cabinets can be hung and adjusted horizontally.
 - e. Weight capacity: Total equipment rack plus 2600 pounds. Work surface plus 925 pounds. Shelf unit plus 550 pounds.
3. Support Structures
 - a. General requirements for mobile workstation:
 - b. Riser uprights: 11 gauge rolled steel supplied with two parallel rows of machine threaded welded nuts that accept bolts that positively engage the table and shelf frames.
 - c. Frames: Rolled steel, resistance welded. Frame members and tie rail brackets: 11 gauge; corner gussets: 11 gauge.
 - d. Bottom shelf rails: 11 gauge cold rolled steel.
 - e. Base cover: 18 gauge cold rolled steel.
 - f. Slotted adjustment machined into riser upright: punched for one-inch adjustment of components supported off riser upright.
 - g. Stainless steel retaining rods at the back and side of work surfaces for loading safety and visual and physical load barriers. Upper shelves to accommodate retaining on both sides, back and front edges,
4. Finishes
 - a. Metal Finish:
 - 1). Preparation: Spray clean metal with a heated cleaner/phosphate solution, pretreat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.
 - 2). Application: Electrostatically apply urethane powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thickness: Liquid dripped, solvent based finishes are not acceptable.
 - a). Exterior and interior exposed surfaces: 1.5 mil average and 1.2 mil min.
 - b. Surface Finish Tests:
 - c. All casework construction and performance characteristics shall be in full compliance with SEFA 8 – 1998 standards.
5. Hardware: As specified elsewhere in this Section.

2.6 SHELVING ASSEMBLIES

- A. Solid Laminated Wood: Edge grain maple of 1 inch thickness with edge grain exposed. Composed of solid hard maple strips 1 inches wide, glued with water-resistant resin under heavy pressure side to side and end to end. Round top edges and corners and sand smooth. Finish with three coats of moisture and chemical resistant natural varnish applied to all surfaces and edges fine sand between coats. For locations see detail 7/lf4.02.

- B. High-Pressure Decorative (Plastic) Laminate Shelving:
1. Manufacturers/Facing material: Products complying with this specification may be provided by the following manufacturers.
 - a. Nevamar Decorative Surfaces, One Nevamar Place, Hampton, SC 29924 Tel: 800 638-4380.
 - b. Pionite Decorative Surfaces, One Pionite Road, P.O. Box 1014, Auburn, ME 04211 Tel: 800 746-6483.
 - c. Wilsonart International, 2400 Wilson Place, P. O. Box 6110, Temple, TX 76503 Tel: 800 433-3222.
 - d. Approved substitution (no known equal).
 2. Approved Products:
 - a. Nevamar ChemArmor.
 - b. Pionite ChemGuard.
 - c. Wilsonart ChemSurf
 3. Color: To be selected by Architect.
 4. Description:
 - a. High-pressure decorative laminate, meeting or exceeding NEMA Standard LD3 2005 Grade HGP, HGL, or HGS requirements, consisting of a resin formulation applied over the decorative surface paper to achieve chemical resistance. The decorative paper shall be treated with melamine resin, and the core shall consist of kraft papers impregnated with phenolic resin. Sheets shall be bonded under high temperature and pressure. Product shall be developed for casework, work surface, and shelving surfaces in laboratories.
 - b. Laminate shall be applied to top and bottom surfaces.
 - c. Finish: Fine pebble-grained "crystal" texture or matte texture with slight sheen to minimize smudges and finger marks, and to provide optimum scratch resistance.
 - 1). Gloss: 15-16 +/- 3 gloss units.
 - d. Physical Properties:
 - 1). Reference Standard: Plastic laminates shall meet or exceed ANSI/NEMA Specification LD3-2000 as specified herein.
 - 2). Minimum Thickness: 0.038 inches ± 0.005 inches (0.97 mm ± 0.13 mm).
 - 3). Cleanability: 10 cycles (NEMA LD3 test method 3.4).
 - 4). Boiling Water Resistance: No effect (NEMA LD3 test method 3.5).
 - 5). High Temperature Resistance: Slight effect (NEMA LD3 test method 3.6).
 - 6). Scratch Resistance: 4.5 Newtons (NEMA LD3 test method 3.7).
 - 7). Ball Impact Resistance: 60 inches (1524 mm) (NEMA LD3 test method 3.8).
 - 8). Radiant Heat Resistance: 200 sec (NEMA LD3 test method 3.10).
 - 9). Dimensional change:
 - 10). Machine direction: 0.50% (NEMA LD3 test method 3.11).
 - 11). Cross direction: 0.80% (NEMA LD3 test method 3.11).
 - 12). Wear resistance: 1,500 cycles, min. (black); 700 cycles, min. (other colors) (NEMA LD3 test method 3.13).
 - 13). Blister Resistance: 70 sec (NEMA LD3 test method 3.15).
 - 14). Stain Resistance Performance Test Results: The surface shall show essentially no effect on Black (Lab grade) plastic laminate when left in contact for 16 hours either when reagents were kept covered or allowed to evaporate.

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no

2	Good	change in function or life of the surface. A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

Acids

	Concentration	Rating
Acetic acid	All	0
Aqua regia		0
Chromic trioxide (Chromic acid cleaning solution)		1
Glacial acetic acid	99%	0
Hydrochloric acid	All	0
Hydrofluoric acid	48%	0
Formic acid	All	0
Nitric acid	All	3
Sulfuric acid	All	0
Perchloric acid (concentrated)		0
Phosphoric acid	All	0
Picric acid	1.2%	0
Tannic acid (saturated)		0
Uric acid (saturated)		0

Alkalis

Ammonium hydroxide	All	0
Sodium hydroxide	All	3
Sodium sulfide	15%	0

Solvents

Acetone		0
Amyl acetate		0
Amyl alcohol		0
Butyl alcohol		0
Carbon disulfide		0
Carbon tetrachloride		0
Chlorobenzene		0
Chloroform		0

Solvents	
Cresol	0
Dimethylformamide	0
Dioxane	0
EDTA	0
Ethyl acetate	0
Ethyl alcohol	0
Formaldehyde	0
Methanol	0
Methyl ethyl ketone	0
Methylene chloride	0
n-Hexane	0
Naphthalene	0
Phenol	0
Tetrahydrofuran	0
Toluene	0
Trichlorethane	0
Xylene	0

General Reagents	
Alconox (lab detergent)	0
Aluminon	0
Ammonium phosphate	0
Aromatic ammonia	0
Benedicts solution	0
Calcium hypochlorite (concentrated)	0
Camphorated parachlorophenol	1
Cellosolve	0
Copper sulfate	0
Ethylene glycol	0
Eucalyptol	0
Formalin	0
Gasoline	0
Hydrogen peroxide	3% 0
Iodine	0
Karl Fisher Reagent	0
Kerosene	0
Lactated ringers	0
Lysol	0
Methyl methacrylate	0
Mineral Oil	0
Monsel's solution (Ferric subsulfate)	0
Naphtha	0
Petroleum jelly	0
Phosphate buffered saline (PBS)	0
Pine oil	0
Potassium permanganate	0
Povidone iodine	0
Procaine	0
Quaternary ammonia compounds	0

General Reagents		
Silver nitrate		0
Sodium azide		0
Sodium chromate		0
Sodium hypochlorite	5%	0
Sodium thiocyanate		0
Sucrose	50%	0
Thymol & Alcohol		0
Tincture of Iodine		0
Tincture of Mercurochrome		0
Tincture of Merthiolate		0
Trisodium phosphate	30%	0
Urea		0
Vegetable oils		0
Water		0
Zephiran chloride		0
Zinc chloride		0
Zinc oxide ointment		0

Stains and Indicators		
Ag Eosin Bluish 5% in Alcohol		0
Bromothymol Blue		0
Cresol Red		0
Crystal Violet		0
Gentian Violet	1%	0
Gram Stains		0
Malachite Green		0
Methyl Orange		0
Methyl Red		0
Methylene Blue		0
Nigrosine		0
Safranin O		0
Sudan III		0
Thymol Blue		0
Wright's Blood Stain		0

5. Plastic laminate adhesive: High-pressure decorative laminate shall be bonded to core with thermosetting resorcinol or phenol-resorcinol adhesive, or as recommended by the manufacturer for the application, at temperature above 65°F (18.3°C) at a pressure no less than 15 pounds per square inch. Laminate core is not to exceed 10% moisture content and is to be laminated and cured in a controlled environment between 45% and 60% RH.
6. Core material: Shop Sanded Exterior Grade Veneer Plywood with Hardwood Plywood Veneer Association K+ face veneers.
 - a. Thickness/Plies:
 - 1). 1 inch (25 mm): minimum 9-ply.
 - b. Physical Properties:
 - 1). Average modulus of rupture: 7346 psi (50.65 N/mm²).
 - 2). Face Screw Holding Strength: 355 lbf (1579 N).
7. Edging:
 - a. Unless otherwise indicated, all edges shall be edgebanded with 3 mm PVC edge banding set in hot melt adhesive. Adhesive shall have a minimum softening

point of 150°F (65.6°C). Apply primer to substrate when recommended by adhesive manufacturer. Contact cement is not acceptable. Color of edgebanding to be selected by the Architect.

- b. Safety Edges:
 - 1). Types:
 - a). Retainer Rail: ¼ inch (6 mm) diameter stainless steel retainer rail, as indicated on the drawings.
 - 2). Refer to the description of each system below for locations of each type.

C. Adjustable Wall Shelves:

- 1. Shelving: High-Pressure Decorative Laminate shelving as specified above.
- 2. Double Slot Shelf Standards:
 - a. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
 - 1). Knapé & Vogt Manufacturing Company, 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505 Tel: 616 459-3311.
 - 2). Approved substitution.
 - b. Basis of Design: Knapé & Vogt 85 ANO series uprights, or equal. Length as indicated on the drawings.
- 3. Shelf Brackets: 16 gauge (1.6 mm) bookend type, as detailed on drawings.
- 4. Safety edging:
 - a. Front Edge:
 - 1). Retainer rail.
- 5. Load capacity: System shall support a minimum of 35 pounds per square foot applied at all shelves simultaneously. Maximum deflection shall be 0.35 inches (9mm) under load.
- 6. Finish: Factory finish standards and brackets with epoxy powder coating. Color to be selected by the Architect.

D. Heavy Duty Wall Shelves:

- 1. Shelving: High-Pressure Decorative Laminate shelving as specified above. All shelves to be one piece continuous full length of assembly.
- 2. Heavy duty shelf standards: Slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.
- 3. Heavy duty shelf brackets:
 - a. Shelf Brackets: Cold-formed steel, slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.
- 4. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.
- 5. Select one of the following types of safety edging, or delete entirely if no safety edging is required. Safety edging, provide at all four edges of each shelf:
 - a. Retainer rail.
 - b. Extended height PVC band.
 - c. Extended height acrylic band.
- 6. Load capacity: System shall support a minimum of 50 pounds per square foot applied at all shelves simultaneously. Maximum deflection shall be 0.35 inches (9mm) under load.

2.7 CYLINDER AND DEWAR RESTRAINT ASSEMBLY

A. Cylinder Rack Assembly:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
 - a. Safe-T-Rack Systems, Inc., 4325 Dominguez Rd., Suite A, Rocklin, CA 95677 Tel: 800 344-0619.
 - b. Spectra Gases, Inc., 3434 Route 22 West, Branchburg, NJ 08876 Tel: 800 932-0624.
 - c. Matheson Tri-Gas, 166 Keystone Drive, Montgomeryville, PA 18936 Tel: 215 648-4000.
 - d. Scott Specialty Gases, Inc., 6141 Easton Road Box 310, Plumsteadville, PA 18949 Tel: 215 766-8861.
 - e. Approved substitution.
 2. Frame members: 2 inches x 2 inches x 1/8 inch (50 x 50 x 3 mm) square steel tube.
 3. Construction: All welded. Weld cover plates to close exposed tube ends. Grind and polish all welds to produce smooth surface with no visible evidence of welding when painted. Drill 9/32 inch (7 mm) diameter holes in top rails for retaining rods, as shown on the Laboratory Furnishing drawings.
 4. Chain: Provide restrainers of 5/16 inch diameter, Type 304 stainless steel welded chain fitted with stainless steel snap shackle with swivel clevis and split ring for each bracket; McMaster-Carr Supply Company, Suncor Marine & Industrial, Inc., or approved substitution.
- B. Cylinder and Dewar Chain Assembly:
1. Framing channel, Fittings, Swivel Hangers, and End Caps: Slotted channel framing as specified elsewhere on this Section. Provide two swivel hangers per cylinder or dewar per wall bracket
 2. Chain: Provide restrainers of 5/16 inch diameter, Type 304 stainless steel welded chain fitted with stainless steel snap shackle with swivel clevis and split ring for each bracket; McMaster-Carr Supply Company, Suncor Marine & Industrial, Inc., or approved substitution.
 3. Cylinder racks and restraint components shall be factory-finished. Color to be selected by the Architect.

2.8 OVERHEAD SERVICE CARRIERS

- A. Materials:
1. Support Framing: Slotted channel framing as specified elsewhere on this Section.
 2. Brake-formed metal: 16 gauge (1.6 mm) galvanized steel with epoxy powder-coated finish.
- B. Fabrication: Fabricate and assemble components as detailed on the drawings.
- C. Coordination: Carefully coordinate location of supports with the work of other Sections.
- D. Finish: As specified for slotted channel framing. Color shall be selected by the Architect.

2.9 CABLE TRAY SYSTEM

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
1. Chalfant Cable Trays, 11525 Madison Avenue, Cleveland, OH 44102 Tel: 216 521-7922.
 2. No known equal.

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- B. 6" wide wall mounted cable tray to match overhead service carrier cable tray where it is called out on LF plans.
 - C. Provide a Cable Tray system, complete with straight and curved sections, fittings, connectors, hardware and miscellaneous devices required for a complete installation.
 - D. Cable Tray shall be suspended from Overhead Service Carrier specified above and located in laboratories as shown on the Laboratory Furnishings Drawings.
 - E. Construction shall be Trough Type extruded aluminum 6063-T6 alloy. Maximum spacing between transverse members shall be 4 inches (102 mm) measured parallel to side members. Cable bearing members shall be a minimum of 1 inch (25 mm) and shall be welded to side rail to insure integrity of the ground fault path.
 - F. Material shall be extruded Anodized Aluminum Alloy Type 6063-T6, NEMA VE-1 Class 12B.
 - G. Cable Tray shall be 18 inches (305 mm) wide at Over Head Service Carriers except as otherwise noted. Side rails shall be 3 inches (102 mm) high. Curved section radius shall be 12 inches (305 mm).
 - H. Connectors: High pressure, rigid type connectors attached by ribbed neck hardened steel screws and locking type nut which does not require a washer. Hardware shall be cadmium plated. Ribbed neck portion of screw shall prevent screw from rotating during tightening of nut.
 - I. T-connectors and 90 degree connectors to be provided as shown on plans where wall and overhead service carrier cable tray intersect.
 - J. Grounding Continuity: Cable tray systems and all components shall be provided and installed per their listings and per manufacturer's instructions so that the completed system is electrically continuous and provides an approved equipment grounding path in accordance with NEC Article 392. Where cable tray components are not mechanically and electrically continuous, the system shall be provided with approved bonding jumpers and connections in accordance with NEC Article # 392 and Article # 250.96. Where bonding jumpers are utilized they shall be a minimum of #2 AWG copper with suitable, listed fittings. All system testing shall be in accordance with NEMA requirements.
 - K. Install all cable tray and support systems components in accordance with NEMA VE-1, applicable code requirements and with manufacturer's written instructions.
 - L. Vertically support at each end of run, at all turns, branches and connection point, and at intervals not to exceed ten feet maximum.
 - M. Use expansion fittings and connectors at all locations requiring movement.
 - N. Install warning signs at nominal intervals at 20 feet (6 m), visible from below.
 - O. Warning Signs: Provide engraved nameplates, using 1/2 inch (12.7 mm) high black letters on yellow background with the following warning label:
WARNING --- MECHANICAL SUPPORT FOR CABLES & RACEWAY ONLY. DO NOT USE AS A WALKWAY, LADDER OR SUPPORT.
 - P. Listings:

1. National Electrical Code, currently enforced edition, including all State and local amendments applicable to this project.
2. ASTM A123 and ASTM A525.
3. NEMA VE-1: Metallic Cable Tray Systems.
4. Underwriters Laboratories: All tray systems shall be UL listed as an assembly.

Q. Refer to Laboratory Furnishings Drawings for locations and details.

2.10 WALL-MOUNTED ATTACHMENT CHANNEL

- A. Product Characteristics: Wall-mounted framing channel, designed to support 200 lb point (0.89 kN) load at any position and 50 lb/lf (0.73 kN/m) uniformly distributed load. All brackets, channels, etc. shall be provided for a complete installation.
- B. Materials: Slotted channel framing as specified elsewhere on this Section.
- C. Fabrication: Fabricate and assemble components as detailed on the drawings.
- D. Coordination: Carefully coordinate location of supports with the work of other Sections.

2.11 PIPE DROP ENCLOSURE

- A. Fabricate pipe drop enclosures from minimum 18 gauge (1.3 mm thick) galvanized steel, per details shown on the Laboratory Furnishing drawings, except as noted.
- B. Seal all joints between dissimilar metals and at all panel seams with clear silicone sealant.
- C. Materials and finish shall be as specified under Metals Fabrications in this Section.

2.12 DRYING RACK

- A. Stainless Steel Drying Rack with White Polypropylene Pegs:
 1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
 - a. Inter Dyne Systems, Inc., 676 Ellis Road, Norton Shores, MI 49441 Tel: 231 799-8760.
 - b. Approved substitution (no known equal).
 2. Basis of Design: Inter Dyne Systems "V" Victoria Series, modified as indicated on the drawings.
 - a. Drying rack bodies shall be of one-piece design and of not less than 20 gauge (1.0 mm thick) Type 304 stainless steel with a No. 4 finish. The top shall have two 90-degree bends, and sides to have one 90 degree bend.
 - b. Each rack shall have an integral full-width 20 gauge (1.0 mm thick), Type 304 stainless steel drip trough with stainless steel drain tube. Drip trough shall be continuously welded.
 - c. The trough shall have a full-length, Type 304 stainless steel wire mesh screen insert. Screen insert shall be turned down on all four sides to provide a clean and finished appearance.
 - d. Each rack front shall be dimensioned and punched with T-shaped holes to accommodate the peg arrangement shown on the drawings.

3. Pegs shall fit into the punched holes in the rack front. A T-shaped protrusion on the base of the pegs shall allow easy removal and replacement without the need for tools. The T-shaped holes shall be designed to fit the protrusion on support pegs for holding single or multiple utensil drip trays, drain shelves, funnel racks or pipette holders. Pegs shall be of injection-molded white polypropylene.
4. Provide wall hangers for each rack, designed to enable the removal and replacement of the entire rack for cleaning without the need for tools.
5. Provide stainless steel fixing screws of appropriate type for attachment to support structure.
6. Provide clear, tight-fitting hose to drain from drip trough drain tube into sink.
7. Provide finished stainless steel back panel when any portion of the back of drying rack is exposed.

2.13 CABLE GROMMET

- A. Provide 3 inch (75 mm) diameter wire or cable access through ports of Type 304 stainless steel with No. 4 finish at bench tops as located and detailed on the Laboratory Furnishings drawings.

2.14 LASER CURTAIN AND TRACK ASSEMBLY:

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
 1. Kentek Corporation, 19 Depot Street, Pittsfield, NH 03263, Tel: 800 432-2323.
 2. Control Optics Corporation, 1445 Brooks Street, Suite H, Ontario, CA 91762-3665, Tel: 909 983-0788.
 3. Wilson Laser Safety Products, Pomona, CA, Tel: 909 468-3636.
 4. Approved equal.
- B. Standard:
 1. ANSI Z136.1 Safe Use of Lasers.
- C. Performance:
 1. The laser curtain shall afford the required level of protection from direct and diffusely scattered laser light generated by: Class IV lasers.
 2. The threshold limit for beam penetration through the curtain at the minimum distance indicated on the drawings shall not to be exceeded for an exposure time of 60 second.
 3. No part of the installation shall be flammable or support combustion.
 4. No part of the installation shall release toxic fumes following a laser exposure.
- D. Fabrication:
 1. The curtain shall be sewn flat with 10% fullness. The seams shall be sewn French-style (no raw edges visible). The curtain top shall be sewn with grommets adequate to support curtain weight and performance.
- E. Installation:
 1. The laser protection curtain and trackway shall be installed to prevent laser light from exiting the laser controlled area at levels above the applicable MPE (Maximum Permissible Exposure) level.
 - a. Curtain shall be supplied with minimum 11 inch long front and rear light-trap valances. The valances shall be made of the same curtain material, sewn flat (no fullness) with a sewn-on hook and loop strip, and shall be mounted to the curtain track assembly.

2. Laser curtain noted on plans as 14B are made of same materials as Laser curtain 14A. Laser curtain 14B to have 18" gap between bottom of curtain and floor as well as top of curtain and track. No valance is needed.
3. Furnish each curtain with position contacts for connection to the laser safety system.
4. At wall terminations, provide metal channel wall mount fastened to partition. Fabric shall terminate with metal closure piece that latches to wall mount.
5. Attach curtain to wall and fin tube for light tight seal.
6. Curtain Supplier/Installer must provide any bracing necessary at ceiling. Coordinate with ceiling Manufacturer/Installer.

2.15 CLEAN ROOM SOFTWALL

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
 1. Terra Universal, Inc., 800 S. Raymond Avenue, Fullerton, CA 92831. Tel: (714)578-6000.
 2. Approved substitution.
- B. Basis of Design:
 1. 10'x10' Softwall Model# 6600-60-83739.
 2. 11'x11' Softwall Model # 6600-60-83740.
- C. Features:
 1. Status indicator lights.
 2. HEPA fan/filter units to provide a laminar flow or clean air.
 3. Fluorescent lights
 4. Control panel
 5. Cleanroom Vinyl curtains.
 6. Parting strip shields.
 7. Steel support beams
- D. Refer to Laboratory Furnishings drawings for locations.

2.16 FINISH FOR MISCELLANEOUS WOOD ITEMS

- A. Applicability: This section applies to wood fabrications, including, but not limited to, wood laboratory tables, wood-framed balance tables, wood-framed pegboards, and wood filler panels.
- B. Finish:
 1. Manufacturer may uses either of the following finish systems:
 - a. Customized, high-solids, cross-linked, ultraviolet light (UV)-cured coating developed for durability, including abrasion, chemical, impact, and scratch resistance, for flat-line applications. Coatings shall have little or no VOCs. Chemical-resistant modified acrylic urethane finish with built-in UV blocker, or equal, applied over permanent wood stain.
 2. Stain Color:
 - a. To be selected by Architect from manufacturer's full published color range.
 3. Application:
 - a. Finish application and sequence shall be as recommended and designed by the manufacturer for a high quality, laboratory-grade wood casework finish.
 - b. Preparation: Sand exposed surfaces smooth, free from dirt and defects.

- c. Stain application: Apply stain of color selected to all exposed casework surfaces. Apply in a manner to achieve a match with the selected color sample upon completion of application of the finish.
- d. Finish application: Apply top finish to all stained surfaces. Finished surfaces shall be even, water-clear and bright. Cloudy or muddy finishes carrying tinting pigments will not be acceptable.
- e. Stain Color:
 - 1). To be selected by Architect from manufacturer's full published color range.

C. Finish Performance Requirements:

- 1. Chemical resistance: Contractor shall provide verification of wood finish performance. Testing to be performed by independent testing agency.

- a. Procedure: Finished panels shall be oriented horizontally and vertically during exposure to the test chemicals. Chemical concentrations shall be adjusted by the volume method. Ambient temperature and chemical temperature shall be 68°F to 72°F (20°C to 22°C). At the end of the test period, the surface shall be washed with detergent and warm water. Areas exposed to solvents shall be cleaned with a cloth dampened with the respective solvent. Prior to the evaluation, 16 - 24 hours after the chemicals have been removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

- 1). Horizontal Test: Apply five (5) drops of the acid, base or salt substance to the correspondingly numbered areas of the surface to be tested. Position a 1 inch (25.4 mm) diameter watch glass in the liquid, convex side downward. Solvents shall be applied by saturating a 1 inch (25 mm) ball of cotton, then covering with an inverted 2 ounce (56.7 g) wide-mouth bottle. Test duration shall be one hour.
- 2). Vertical Test: The test surface shall be marked to indicate divisions; 12 inches (305 mm) high, ¾ inch (19 mm) wide, and numbered to identify the chemicals. Five (5) drops of each substance shall be applied to its respective numbered area in a vertical track pattern to prevent crossover. Test duration shall be two hours.

- b. Evaluation ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

- c. Minimum acceptable results of chemical resistance test:

Reagent		Horizontal Test Rating	Vertical Rating	Test
Acetic Acid	50%	1	1	
Acetic Acid	75%	2	1	
Hydrochloric Acid	20%	1	1	
Hydrochloric Acid	37%	2	1	
Hydrogen Peroxide	30%	1	1	
Nitric Acid	10%	1	1	

Reagent		Horizontal Test Rating	Vertical Rating	Test
Nitric Acid	25%	2	2	
Phosphoric Acid	50%	1	1	
Phosphoric Acid	75%	1	1	
Sulfuric Acid	25%	1	1	
Sulfuric Acid	50%	2	1	
Glycerin		1	1	
Potassium Hydroxide	40%	1	2	
Potassium Hydroxide	45%	1	2	
Sodium Hydroxide	25%	1	1	
Sodium Hydroxide	35%	1	1	
Sodium Hydroxide	40%	1	1	
Sodium Hydroxide	50%	1	1	
Sodium Chloride	Saturated	1	1	
Sodium Carbonate	Saturated	1	1	
Sodium Hypochlorite	5.25%	1	1	
Zinc Chloride	Saturated	1	1	
Acetone	50%	2	1	
Butyl Alcohol		1	1	
Ethyl Acetate		2	1	
Ethyl Alcohol		1	1	
Ethyl Ether		2	1	
Kerosene		1	1	
Methyl Alcohol		1	1	
Methyl Ethyl Ketone		2	1	
Naphthalene		1	1	
Toluene		2	1	
Xylene		2	1	

2.17 METAL FABRICATIONS

- A. Applicability: This section applies to metal fabrications, including, but not limited to, pipe drop enclosures, radioisotope storage cabinets, shelving support systems, metal-framed laboratory tables, metal-framed balance tables, cylinder racks, utility ceiling tiles, and other miscellaneous brake-formed and shop fabricated components and trim, such as required for overhead service carriers.
- B. Materials:
1. Steel: Cold-rolled furniture stock sheet steel, prime grade, roller leveled.
 - a. Steel shall be treated at the mill to be free of scale, ragged edges, deep scratches, or other injurious effects.
 - b. All gauges indicated are to be U.S. standard.
- C. Finish Requirements:
1. Paint finish for steel laboratory products shall utilize a dry coating process with minimal waste generation. Liquid-applied coatings shall not be acceptable. Manufacturer shall supply documentation that waste generated during the painting process, is a solid, non-hazardous material.
 - a. Pretreatment: Finish process shall incorporate a phosphate conversion coating during the pretreatment/cleaning operation.

- b. Operator Protection: The painting process shall be cleanly contained, have no solvent odor and be performed in an air-conditioned room.
 - c. VOC (Volatile Organic Compounds) emissions shall not exceed 0.29 lbs per gallon (35 g/L).
 - d. Offgasing: No further emissions or "Offgasing/Decomposition" vapors shall occur at room temperature from installed finished parts.
 2. Preparation: After the units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish to the metal and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a heated cleaner/phosphate solution and pretreated with iron phosphate spray followed by a neutral final seal prior to application of final finish. The strength of each solution shall be monitored by filtration to insure consistent quality. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.
 3. Application: Electrostatically apply powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:
 - a. All surfaces, exterior or interior, exposed to view, shall receive sufficient powder coat to achieve an average 1.5 mil (38 μm) film thickness with a minimum 1.2 mil (30 μm) film thickness and shall have smooth satin luster.
 - b. Backs of cabinets and other surfaces not exposed to view shall have sufficient powder coat to achieve an average 1.0 mil (25 μm) film thickness.
 4. All drawer bodies to be finished in matching color.
 5. Concealed interior parts shall receive corrosion-resistant treatment.
 6. Finish must be UV stable.
 7. Color: As selected by the Architect.
- D. Chemical Spot Test Performance Requirements:
 1. Chemical resistance: Contractor shall provide verification of metal finish performance. Testing to be performed by independent testing agency.
 2. Test procedure: A clean, dry, test panel shall be laid flat and level on a horizontal surface. Ambient temperature of 70°F to 76°F (20°C to 22°C) and relative humidity of 45% to 55% shall be maintained for 48 hours. After a test period of one hour, chemicals shall be flushed away with cold water and the surface washed with warm water, detergent, and naphtha and rinse with deionized water. Dry with towel and evaluate after 24 hours, maintaining ambient conditions. Test using one of the following methods:
 - a. Place a reagent-saturated cotton ball in the mouth of a one ounce (30 cc) bottle and inverting the bottle on the surface of the panel.
 - b. Chemical spot tests shall be made by applying 5 drops (approximately 0.5 mL) of reagent to the surface to be tested, covered with a 24 mm watchglass, convex side down.
 3. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	Slight surface etching or severe staining.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.

4	Failure	Pitting, cratering, swelling or erosion of the surface. Obvious and significant deterioration.	
4. Minimum acceptable results of chemical resistance test:			
Reagent	% by wt.	Rating	
Acetic acid	98%	0	
Acetone		0	
Acid dichromate	5%	0	
Ammonium hydroxide	28%	0	
Amyl acetate		0	
Benzene		0	
Butyl alcohol		0	
Carbon tetrachloride		0	
Chloroform		0	
Chromic acid	60%	0	
Cresol		0	
Dichloroacetic acid		1	
Dimethylformamide		0	
Dioxane		0	
Ethyl acetate		0	
Ethyl alcohol		0	
Ethyl ether		0	
Formaldehyde	37%	0	
Formic acid	90%	0	
Furfural		0	
Gasoline		0	
Hydrochloric acid	37%	0	
Hydrochloric acid	48%	1	
Hydrogen peroxide	3%	0	
Methyl alcohol		0	
Methyl ethyl ketone		0	
Methylene chloride		0	
Mono chlorobenzene		0	
Naphthalene		0	
Nitric acid	20%	0	
Nitric acid	30%	0	
Nitric acid	70%	1	
Phenol	90%	0	
Phosphoric acid	85%	0	
Silver nitrate, saturated		0	
Sodium hydroxide	10%	0	
Sodium hydroxide	20%	0	
Sodium hydroxide	40%	0	
Sodium hydroxide, flake		0	
Sodium hydroxide, saturated		0	
Sulfuric acid	33%	0	
Sulfuric acid	77%	0	
Sulfuric acid/Nitric acid, equal parts	77%/70%	1	
Tincture of Iodine		2	
Toluene		0	
Trichloroethylene		0	
Xylene		0	
Zinc chloride, saturated		0	

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- E. Hot Water Test
1. Test Procedure: 190°F to 205°F (88°C to 96°C) hot water shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.5 cc) per minute) on the finished surface, which shall be set at an angle of 45°, for a period of 5 minutes.
 2. Acceptance Level: After cooling and wiping dry, the finish shall show no visible effect from the hot water.
- F. Paint Adhesion on Steel Test
1. Test Procedure: Test shall be based on ASTM D2197-86 “Standard Method of Test for Adhesion of Organic Coating.” Two sets of eleven parallel lines 1/16 inch (1.587 mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid to 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush surface lightly with a soft brush for one minute. Examine under 100 fc (1076 lux) of illumination.
 2. Acceptance Level: Ninety or more of the squares shall show finish intact.
- G. Impact Test
1. Test Procedure: Drop a 1 lb (0.4536 kg) ball (approximately 2 inch (50.8 mm) diameter from a distance of 12 inches (305 mm) onto a flat horizontal surface, coated to manufacturer’s standard manufacturing method.
 2. Acceptance Level: No visual evidence to the naked eye of cracks in the finish due to impact.
- H. Paint Hardness on Steel Test
1. Test Procedure: Paint film shall be tested with pencils of various hardnesses. Pencils shall have a wide, sharp edge. Pencils shall be pushed across surface in a chisel-like manner.
 2. Acceptance Level: Finish film shall not rupture from a sharpened 4H pencil.

2.18 STAINLESS STEEL FABRICATIONS

- A. Applicability: This section applies to stainless steel fabrications, including, but not limited to drying racks, stainless steel pipe drop enclosures, and other miscellaneous brake-formed and shop fabricated stainless steel components and trim as shown on the drawings.
- B. Material: Unless otherwise noted stainless steel shall be Type 304 and shall be of gauge indicated on Laboratory Furnishing drawings or this specification.
- C. Finish: All fabrications shall have exposed surfaces ground and polished to a Number 4 satin finish.
- D. All stainless steel nuts, screws, bolts, and rivets, etc., shall be of the same type stainless as in the sheet material and shall have a tumbled finish closely resembling that of a Number 4 finish.
- E. All stainless steel welding material shall be of type similar to the sheet material or a richer quality. All welds shall be made without discoloration and shall be ground, polished, and passivated to blend harmoniously with a Number 4 satin finish. All joints in stainless steel tops and work surfaces shall be welded.

2.19 SLOTTED CHANNEL FRAMING

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
1. Unistrut, 35660 Clinton Street, Wayne, MI 48184 Tel: 800 521-7730.
 2. Power Engineering Co. (Powerstrut), 420 Boston Turnpike, Shrewsbury, MA Tel: 800 274-1303.
 3. Kumar Industries (Nu-Strut), 4881 Chino Ave., Chino, CA 91710 Tel: (909) 591-0722.
 4. Cooper B-Line Inc. (B-Line), 509 West Monroe St., Highland, IL 62249 Tel: (618) 654-2184.
 5. Approved substitution.
- B. Materials: Channel and framing members shall be fabricated from steel conforming to the following requirements:
1. Framing Members:
 - a. Concealed Framing Members and Fittings: ASTM A570 GR 33.
 - b. Exposed Framing Members and Fittings: ASTM A446 GR A with zinc coating conforming to ASTM A525.
 - c. Stainless Steel Framing Members and Fittings: ASTM A240 (Type 304), where indicated.
 2. Fittings:
 - a. Concealed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307.
 - b. Exposed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307. Exposed fittings shall receive zinc coating conforming to ASTM A525.
 - c. Stainless Steel Fittings and Hardware: Sintered Nuts shall be of ASTM B783 (Type 316N2-33) stainless steel and fittings shall be of ASTM A240 (Type 304) stainless steel. Stainless steel fittings and hardware shall be used with stainless steel framing members, or where indicated.
 3. Thickness: 12 gauge, unless noted otherwise.
 4. Size: 1 5/8 inch x 1 5/8 inch cross-section, unless noted otherwise.
- C. Components:
1. The following components shall be provided, unless otherwise noted:
 - a. Framing Channel: 1 5/8 inch x 1 5/8 inch x 12 gauge: Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equal.
 - b. Suspended Framing Channel, 3 1/4 inch x 1 5/8 inch x 12 gauge: Unistrut P5000, Powerstrut PS 100, Kumar Industries N-150, B-Line Systems, Inc. B11, or equal.
 - c. 90° Angle Fitting: 4 1/8 inch x 3 1/2 inch x 1/4 inch with two holes, each leg: Unistrut P1325, Powerstrut PS 607, Kumar Industries N-1123, B-Line Systems, Inc. B104, or equal.
 - d. 135° Angle Fitting: 3 inch x 2 5/16 inch x 1/4 inch with one hole, each leg: Unistrut P1546, Powerstrut PS 633-45°, Kumar Industries N-1425, B-Line Systems, Inc. B154, or equal.

- e. T-Shaped Flat Plate Fitting: 5 3/8 inch x 3 1/2 inch x 1/4 inch plate, T-shaped, with four holes: Unistrut P1031, Powerstrut PS 714, Kumar Industries N-1022, B-Line Systems, Inc. B133, or equal.
 - f. Wing Shape Fitting, 9 5/32 inch x 3 7/8 inch ten holes, two holes in each wing section and two holes in each of three channel section sides: Unistrut P2347, Powerstrut PS 913, B-Line Systems, Inc. B273.
 - g. Vertical Posts: 3/4 inch x 1 5/8 inch x 12 gauge, double channel section: Unistrut P1001, Powerstrut PS 200 2T3, Kumar Industries N-200-A, B-Line Systems, Inc. B22A, or equal.
 - h. Horizontal Support Members: 1 5/8 inch x 1 5/8 inch x 12 gauge framing channel with 13/32 inch x 3 inch slotted holes, 4 inches on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S, or equal.
 - i. Slotted Hole Framing Channel, 1 5/8 inch x 1 5/8 inch x 12 gauge framing channel with 13/32 inch x 3 inch slotted holes, 4 inches on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S.
 - j. Slotted Framing Channel for installation in Chemical Fume Hoods, 1 5/8 inch x 13/16 inch x 16 gauge Type 316 stainless steel framing channel: Unistrut P4000 SS, Powerstrut PS 560 SS, Kumar Industries, B-Line Systems, Inc.
 - 1). Attach channel to side of fume hood with 2 5/8 inch x 1 7/8 inch x 1/8 inch, 4 hole, stainless steel 90° fitting: Unistrut P6325 SS, Powerstrut, Kumar Industries, B-Line Systems, Inc.
 - k. Diagonal Brace Supports: Framing Channel, 1 5/8 inch x 1 5/8 inch x 12 gauge: Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equal.
 - l. Closure Strip: 0.04 inches thick snap-in cover for framing channel: Unistrut P3184, Powerstrut PS 6152, Kumar Industries N-1920, B-Line Systems, Inc. B217-24, or equal. Provide closure strips over all exposed vertical post sections.
 - m. End Caps: 0.06 inches thick for framing channel: Unistrut P1280, Powerstrut PS 707, Kumar Industries N-2500, B-Line Systems, Inc. B205, or equal. Provide end caps for all exposed horizontal framing channels.
 - n. Ceiling Escutcheon: Provide 18 gauge steel, finished to match framing members, as indicated on the Laboratory Furnishing drawings, at ceiling penetrations.
 - o. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.
2. Service Struts and Ledging:
- a. 16 gauge, 13/16 inch x 1 5/8 inch cold-formed framing uprights: Unistrut P4000, Powerstrut PS 560, Kumar Industries N-400, B-Line Systems, Inc. B56, or equal. Uprights shall be provided at 48 inches, maximum, and fastened top and bottom by two adjustable U-shaped spreaders.
 - b. U-shaped spreaders: 12 gauge by 1 1/2 inch (45 mm) wide by length required, galvanized steel.
 - c. Locations:
 - 1). Provide to support tops at pipe service chase space, support drain troughs, under fume hood superstructures, and other abnormal loads.
 - 2). Support struts with U-shaped spreaders shall be provided at 48 inches (1220 mm) on center below island and peninsula benches, as indicated on drawings. Support struts shall be provided along wall 48 inches (1220 mm) on center below island and peninsula benches. Struts will be used to support piped and electrical services installed under Divisions 22, 26, and 27. Provide all bolts, expansion sleeves, and

- fastening devices for a complete assembly. Pipe and conduit hangers shall be provided by Division 22, 26, and 27 installers.
3. Adjustable Wall Shelving:
 - a. Shelf Standards: Framing channel, spaced equally, 36 inches (915 mm) on center, maximum. Provide all bolts and fastening devices for a complete assembly.
 - b. Brackets: Cold-formed framing channel brackets, as required for maximum cover of shelf depth:
 - 1). Shelves at least than 9 inches and less than 11 inches deep: Unistrut P1769, Powerstrut PS 732-8, B-Line Systems, Inc. B187, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
 - 2). Shelves at least than 11 inches and less than 13 inches deep: Unistrut P1771, Powerstrut PS 732-10, B-Line Systems, Inc. B541, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
 - 3). Shelves at least 13 inches and less than 15 inches deep: Unistrut P1773, Powerstrut PS 732-12, B-Line Systems, Inc. B289-12, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
 - 4). Shelves at least 15 inches and less than 17 inches deep: Unistrut P1775, Powerstrut PS 732-14, B-Line Systems, Inc. B289-14, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
 - 5). Shelves at least 17 inches and not exceeding 20 inches deep: Unistrut P1777, Powerstrut PS 732-16, B-Line Systems, Inc. B290, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
 4. Cylinder and Dewar Restraint:
 - a. Swivel Hanger: 1 3/4 inch long by 3/8 inch diameter link welded to threaded stud; provide two per cylinder: Unistrut M2350, Powerstrut PS205, Kumar N-2911, B-Line 446B.
 5. Finish:
 - a. Provide finish coating for all cold-formed framing components, except for stainless steel components.
 - b. Concealed Framing Members and Fittings: Rust inhibiting acrylic enamel paint applied by electrostatic deposition, after cleaning and phosphating, and thoroughly baked. Finish shall withstand a minimum of 400 hours salt spray when tested in accordance with ASTM B117. Color: Green.
 - c. Exposed Framing Members and Fittings: Factory applied epoxy powder coat. Color: To be selected by the Architect.

2.20 SEALANT

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 1. Dow Corning Corporation, P.O. Box 994, Midland, MI 48686 Tel: 989 496-7881.
 2. General Electric Company, 260 Hudson River Rd., Waterford, NY 12188 Tel: 800 255-8886.
 3. Approved substitution.
- B. Basis of Design Products:
 1. Dow Corning 732 Multi-Purpose Sealant
 2. GE Silicones RTV 100 Series

- C. Characteristics:
1. Type: One-part silicone rubber, MIL-A-46106.
 2. Physical form: Non-slumping paste.
 3. Cure: Cures at room temperature on exposure to water vapor in the air.
 4. Authorizations:
 - a. FDA Regulation No. 21 CFR 177.2600.
 - b. USDA Rating P1.
 - c. NSF Rating C2.
 - d. UL 150 C Rating, File No. E40195(N).
 5. Properties:
 - a. Tack Free Time: 45 minutes, maximum.
 - b. Durometer, Shore A Hardness: 20, minimum.
 - c. Tensile Strength: 220 pounds per square inch, minimum.
 - d. Elongation: 350 percent, minimum.
 - e. Extrusion Rate: 220 to 525 grams per minute.
 - f. Color: Clear

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Inspection:
1. Prior to installation of the work of this Section, carefully inspect the installed work specified in other Sections and verify that all such work is complete to the point where this installation may properly commence.
 2. Verify that all work may be installed in complete accordance with the original design, reviewed submittals, and the manufacturer's recommendations.
- B. Discrepancy: In the event of discrepancy, immediately notify the Architect.
- C. Flooring: Casework will typically be installed on top of finished flooring. Coordinate sequencing, protection, and installation requirements with the contractor to prevent damage of flooring.

3.2 INSTALLATION

- A. Coordinate work with any Owner furnished and/or installed components indicated on drawings.
- B. Installation shall comply with all applicable requirements of SEFA 2, unless otherwise specified in this section.
- C. Shim cabinets as required using concealed shims for a plumb, level, true and straight installation.
1. Shimming shall be minimized as much as possible, yet be sufficient to achieve a level and plumb condition.
 2. Shimming shall maintain the required height of countertops. ADA-height countertops shall not vary more than 1/4" from the heights off the finish floor as indicated.
 3. Where floor conditions require shimming of more than 3/4" at any point, do not install casework in those locations. Notify the contractor and design team that remedial measures will be required to bring the floors closer to a level situation.
- D. Installation materials:

1. Installation of wood, plastic laminate, and solid phenolic casework may involve the use of shims, spacers, cleats, straps and other such items of either metal or wood composition.
 2. Installation of metal casework shall use shims, spacers, cleats, and straps of galvanized steel, epoxy-coated steel, or stainless steel. No wood materials of any sort shall be part of the permanent installation of metal casework.
 3. Installation of stainless-steel casework, counters, and scullery sinks shall use shims, spacers, cleats, and straps of stainless steel of the type specified for the casework construction. No wood materials of any sort shall be part of the permanent installation of stainless steel casework.
 4. Installation of polypropylene casework shall use shims, spacers, cleats, straps, and other such items of polypropylene construction only. No wood or metal materials shall be part of the permanent installation of polypropylene casework.
- E. Scribe tops as necessary for close and accurate fit.
- F. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining units to a tolerance of 1/16 inch (1.5 mm).
- G. Wall Units: Securely fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets. Verify that all required backing and reinforcement necessary to support wall-mounted units is in place, secure, and accurately located.
- H. Laboratory Tops:
1. Field Joints: Factory-prepared and identical to factory joints, locate only where indicated on approved Shop Drawings. Field processing of top and edge surfaces is not acceptable, except as described by manufacturer in approved Submittal Data. Provide full length, one-piece tops and backsplashes wherever possible, and keep field joints to an absolute minimum.
 2. Abut top and edge surface in one true plane, with internal supports placed to prevent any deflection. Joints in top units shall be flush and the narrowest for the respective materials of construction. Cement joint in accordance with the manufacturers' specifications.
- I. Sealant:
1. Do not install sealant until painting of adjacent and surrounding surfaces is complete.
 2. Follow manufacturer's installation instructions and standards. Thoroughly clean all surfaces prior to application. Prime any surfaces as applicable as recommended or required by manufacturer's installation instructions.
 3. At all laboratory spaces, unless indicated otherwise, caulk edges of fixed tops, backsplashes and side splashes to adjacent fixed surfaces with silicone sealant.
 4. Sealant to remain unpainted.

3.3 DESTRUCTIVE TESTING

- A. The Owner, Architect, and/or Contractor may, at their own cost, elect to perform destructive testing on casework cabinet components (such as fronts, sides, etc.) to confirm compliance with the requirements of this specification. The casework manufacturer/installer should account for the de-installation, repair, and reinstallation, or replacement of one cabinet that may be selected for destructive testing.

3.4 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as approved by the Architect at no additional cost to the Owner.
- B. Clean finished units, touch up as required, and remove and refinish damaged or soiled areas.
- C. Cover tops with kraft paper or polyethylene sheeting after installation for protection against scratching, soiling, and deterioration during remainder of construction period. Remove protection prior to final cleaning.
- D. Clean counter tops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

END OF SECTION 11 5310

SECTION 11 5313 – FUME HOODS AND OTHER AIR CONTAINMENT UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Chemical Fume Hoods, including bench mounted hoods.
- B. Laminar Flow clean benches
- C. Welding Snorkel
- D. Gas Safety Cabinets

1.2 RELATED SECTIONS

- A. Section 11 5310: Laboratory Casework and Other Furnishings
- B. Section 11 5343: Laboratory Service Fittings and Fixtures
- C. Division 22: Plumbing
- D. Division 23: HVAC
- E. Division 23: Mechanical
- F. Division 26: Electrical

1.3 REFERENCES

- A. Chemical fume hoods:
 - 1. ASHRAE 110-1995 Method of Testing Performance of Fume Hoods.
 - 2. Conform to the recommended practices for laboratory fume hoods published by the Scientific Equipment and Furniture Association (SEFA) 1-2002.

1.4 DESCRIPTION

- A. Provide equipment complete with accessories as described herein and shown on Laboratory Furnishings drawings.
- B. Chemical fume hoods:
 - 1. Fume hoods with accessories shall be pre-piped and pre-wired. Pre-pipe service fittings to single point connection at 6 inches (150 mm) above top of hood or as otherwise shown.
 - a. Refer to Section 115343 and details on Laboratory Furnishings drawings for service fittings.
 - b. P-trap, waste piping and tailpiece extensions for cupsinks shall be furnished and installed by Division 22. Comply with Division 22 requirements for piping and installation requirements for respective pre-piped services, except that, in any case, piping for natural gas shall be standard weight wrought black iron.

- c. Pre-wire all electrical devices to junction box at top of hood. Comply with Division 26 requirements for electrical work.

1.5 SUBMITTALS

- A. Refer to the General Conditions and Division 1 “Submittal Procedures” for submittal requirements. In addition to these requirements, provide submittal requirements specified herein.
- B. Submittal requirements:
 - 1. Submittal shall be prepared individually for this specification section. Arrange product data, drawings and information for submission in a complete set for this specification section.
 - 2. Submittal shall contain complete data for all items of this specification section. Periodic or partial submittals of individual components within this specification section will be returned as incomplete and rejected.
 - 3. Submittals shall be organized by specification sequence with section and paragraph number identified.
 - 4. Equipment and components being proposed shall be clearly labeled with all options and accessories indicated and shall be for this specific project. All non-applicable options, items and components shall be deleted or struck.
- C. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, and products for Work specified in this Section. Include chemical resistance finish performance test results for any products specified in this section.
- D. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 inches x 17 inches (A3) in size. Blue line prints are not acceptable.
- E. Submit detailed anchorage and attachment detail drawings for seismic restraint.
- F. Samples: Submit two (2) samples of each type of specified finish and color range available.
- G. Test Reports: Submit the following performance test reports.
 - 1. “As Manufactured” (AM) Fume Hood Testing in Manufacturing Facility: Provide certification that each type and size of fume hood has achieved an AM performance rating equal or better than 0.05 ppm with 4.0 Lpm tracer gas release rate when tested in accordance with ASHRAE 110-1995.
 - 2. Fume Hood Certification: Submit “As Installed” (AI) test report as described elsewhere in this section.
 - 3. Fume Hood Sound Level Certification: Provide certification of fume hood compliance with design criteria for maximum allowable noise within laboratories.
 - a. For fume hoods operating with a face velocity of 100 fpm, test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Measurements shall be taken 36 inches (915 mm) in front of open sash at 100 fpm (0.51 m/s) face velocity.
 - b. For fume hoods operating with a face velocity of 125 fpm, test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Measurements shall be taken 36 inches (915 mm) in front of open sash at 125 fpm (0.64 m/s) face velocity.

- H. Operations/Maintenance Manuals: Submit under provisions of Section 01700. Submit for Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, and closest factory representative for components and service.

1.6 QUALIFICATIONS

- A. Work in this Section shall be performed by a firm having a minimum eight years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

1.7 COORDINATION

- A. Work of this Section requires close coordination with Work of Divisions 22, 23 and 26 as well as installation of Owner furnished components and Work specified in other Sections. Sequence all Work to ensure an orderly progress in the project without removal of previously installed Work and so as to prevent damage to finishes and products.
- B. Coordinate, furnish, and install chemical fume hoods designed for variable air volume (VAV) or constant air volume (CAV) operation as indicated in the mechanical drawings. The designed exhaust airflow control method (VAV or CAV) shall be confirmed and coordinated prior to submission and shall be clearly indicated in the submittal product documentation.

1.8 SUBSTITUTIONS

- A. Approved Substitution/Approved Equal: In addition to the items required in Division 1, all substitution requests shall include item-by-item comparison of the proposed substitution to this project specification. A copy of the project specification shall be submitted, with each item and subsection of the project specification marked as "Comply" or "Not Comply." In any cases where "Not Comply" is indicated, an explanation of the relative advantages of the proposed design shall be provided.
- B. Substitution shall not affect dimensions shown on Drawings.
- C. The Contractor shall pay for changes to the building design, including engineering design, detailing, utility and service requirements, and construction costs caused by the requested substitution.
- D. Substitutions shall have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
- E. Maintenance and service parts shall be locally available for the proposed substitution.

1.9 WARRANTY

- A. All products will be warranted to be free from defects in materials and workmanship for a period of one year following substantial completion. The manufacturer/dealer/subcontractor shall repair

or replace any products (or parts thereof) that are found to be defective. Replacement will include any parts, labor, shipping, and travel expenses involved.

PART 2 PRODUCTS

2.1 ACCESSIBILITY FOR PERSONS WITH DISABILITIES

- A. Where indicated on Laboratory Furnishings drawings, fume hoods shall be furnished and installed in a manner to make them accessible to persons with disabilities in accordance with the Americans with Disabilities Act and any state or local building code or regulation having jurisdiction. The height of the highest point of access to the work surface above finished floor shall not exceed 34 inches. Fittings for piped services and electrical receptacles shall be of a design and in a location in order to be considered accessible.

2.2 CHEMICAL FUME HOODS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
1. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728 Tel: 800 711-5227.
 2. Jamestown Metal Products, Inc., 178 Blackstone Avenue, Jamestown, NY 14701 Tel: 716 665-5313.
 3. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
 4. Labconco Corporation, 8811 Prospect Avenue, Kansas City, MO 64132 Tel: 800 821-5525.
 5. Mott Manufacturing Limited, 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825.
 6. Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121.
 7. Approved substitution.
- B. Underwriters Laboratory Listing: Fume hoods shall be UL subject 1805 classified. Label shall be attached to the face of each fume hood indicating classification to the UL 1805 standard for Laboratory Fume Hoods.
- C. Materials: The following materials shall be provided, unless superseded by the requirements listed below for specific fume hood types.
1. Steel:
 - a. ASTM A366 mild steel, furniture stock, cold-rolled, pickled, double annealed, and free from rust, scale, scratches, buckles, ragged edges, and other defects.
 - b. Minimum Thickness: 18 gauge (1.2 mm).
 2. Stainless Steel:
 - a. Type 304, ASTM 240, with exposed surfaces ground and polished to a No. 4 finish.
 - b. Minimum Thickness: 16 gauge (1.6 mm).
 - c. Welding: All stainless steel welding material shall be of similar type to sheet material. Welds shall be made without discoloration, ground, polished, and passivated to blend with a No. 4 finish.
 3. Liner and Baffle:
 - a. Typical: Glass-reinforced polyester panel, flame-retardant and self-extinguishing with smooth finish and white color. Flexural strength: 14,000 psi. Flame spread: 15 or less per U.L. 723 and ASTM E84-80. Baffle shall be same material as liner. Liner thickness: 3/16 inch (4.76 mm); baffle thickness: ¼ inch

- (6.35 mm), minimum. Liner performance characteristics shall be as specified below.
4. Glass: 7/32 inch (5.56 mm) laminated safety glass. Glass shall not be etched with manufacturer's name, logo, or any other permanent markings, other than to identify the glass as safety glass. Light fixture lens may be tempered safety glass.
 5. Sash guides: Extruded PVC.
 6. Sash chain: ANSI #35 steel, single strand. Average tensile strength of 2,400 pounds; maximum working load of 480 pounds.
 7. Pulley assembly for sash chain: Finish bored steel drive sprockets and keyed drive, 1/2-inch (12.7 mm) diameter front connector shaft. Rear idler sprockets; double sealed ball bearings type, lubricated. All sprockets steel with zinc dichromate finish.
 8. Sash pull: Full width of sash.
 - a. Material: Steel with chemical resistant powder coating.
 9. Gaskets: White 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood.
 10. Fasteners:
 - a. Exterior structural member attachments: Sheet metal screws, zinc plated.
 - b. Interior fastening devices shall be concealed; exposed screws are not acceptable. (Screw head "caps" not acceptable).
 - c. Exterior fastening devices shall be exposed corrosion-resistant, non-metallic material; exposed screws are not acceptable.
- D. Construction:
1. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4 7/8 inch (124 mm) thick. Wall shall consist of a sheet steel outer shell and a corrosion resistant inner liner, and shall house and conceal steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Panels shall be attached to a full frame construction, minimum 14 gauge (2.0 mm) galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracketry from hood interior.
 2. Access Panel: Access to fixture valves and piping concealed in wall shall be through flush access panels on the inside liner walls, or through removable front posts. Panels shall be secured with PVC extruded gasket or tamperproof, epoxy coated, countersunk, flat head screws providing a tight fit. Hook and loop type attachments and panels held by gravity are not acceptable.
 3. Downdraft bypass: Low resistant type, 18 gauge (1.27 mm) steel chamber; directional louvers are not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a downflow direction. Chamber shall protect user from expelled particulate in the event of an adverse internal reaction.
 4. Baffles: Baffles shall be fixed and non-adjustable.
 5. Ceiling Closure Panels: Panel shall include simple-to-operate means of access to the hood lighting fixture. Finish shall match superstructure exterior. Closure panel shall conceal view of the sash when the sash is in the open position. Provide sash pocket if required to allow correct operation of the bypass.
 - a. Acoustical Ceiling Tile Conditions: Provide 18 gauge steel paneled enclosure from top of hood to 2 inches above the ceiling.
 6. Bypass Grill: Low-resistant type 18 gauge steel with upward directional louvers.
 7. Trim and Side Panels: Provide matching steel trim and side panels, as required, to finish any openings around and between hoods. Finish shall match superstructure exterior.
 8. Finished Back: Provide for any fume hood where back of hood is exposed to view. 18 gauge steel sheet. Finish shall match superstructure exterior.
 9. Exhaust Collar: Integral to fume hood construction. Provide minimum 2 inch extension above top of fume hood sheet metal for connection to exhaust duct transition piece.

- a. Each back-to-back fume hood shall be provided with separate exhaust connections and collars.
10. Exhaust Duct Transition Piece: Furnished by the fume hood manufacturer for installation by the mechanical contractor. Provide contoured (minimum 20 gauge) Type 316 stainless steel exhaust collar, including transition piece, to connect to the fume hood exhaust duct system as shown on the Mechanical Drawings.
 - a. For Multiple exhaust collar fume hood design, manufacturer shall provide exhaust duct manifold transition piece to combine fume hood exhaust outlets into a single connection to the fume hood exhaust duct system as shown on the mechanical drawing.
11. Cup Sink:
 - a. Rectangular with raised rim, color to match work surface, size in accordance with drawings. Comply with Section 115343 requirements.
 - b. Raised Rim Height: ¼ inch (6.35 mm).
12. Piping shall be as specified in Division 22 for respective system.
13. Service Fittings: As shown on Laboratory Furnishings Drawings and specified in Section 115343, factory-installed and complete with all gaskets, grommets and sleeves. No additional holes in fume hood side posts shall be provided for services beyond those required by the construction documents.
14. Alarm (for VAV hoods): Coordinate cut out for fume hood alarm to be provided under Division 23. All cut outs for alarm shall be made in the factory; field cutting is not acceptable.
15. Electrical:
 - a. Pre-Wiring: All fume hood electrical devices shall be factory-installed and wired to a junction box located on top of the hood. Comply with Division 26 requirements for electrical work.
 - 1). Fume hood receptacles shall be wired such that no more than two duplex outlets and the hood lighting are wired through a single circuit.
 - b. Receptacles: Flush mounted, 125V / 20A / 60Hz duplex type, single gang, NEMA 5-20R, 3-wire, grounding type receptacle, one or two per side, or as indicated on the Laboratory Furnishings Drawings, with brushed stainless steel cover plate.
 - c. Receptacles: Flush mounted, 125V / 20A / 60Hz duplex type, single gang, NEMA 5-20R, 3-wire, grounding type receptacle, one or two per side, or as indicated on the Laboratory Furnishings Drawings, with brushed stainless steel cover plate. Each receptacle shall be provided with individual GFCI protection. Feed-through protection is neither desired nor required.
16. Interior Hood Lighting:
 - a. Lighting within hood shall be provided by a protected vapor-proof fluorescent lighting fixture with two lamps (32W T8, electronic ballast, rapid start) operated by an exterior switch with stainless steel cover plate. Lamp size shall not exceed 48 inches; provide multiple fixtures as required.
 - b. Provide safety glass panel cemented and sealed to the hood roof.
 - c. Light level: Average light level on the work surface shall be 80 footcandles (860 lux), minimum.
17. Safety label: Provide self-adhesive polyester label, as described on the drawings. Labels shall indicate safe operating conditions with respect to fume hood sash position. Labels solely indicating 100 fpm face velocity sash position are not acceptable. Manufacturer: Lab Safety Supply Inc., P. O. Box 1368, Janesville, WI 53547 Tel: 800 356-0783, or approved substitution.
18. Hood Finish: As specified elsewhere in this Section.
19. Exterior Color: As selected by Architect from manufacturer's full color line and complying with finish requirements.

20. Pass-through: Provide 3 inch I.D. pass-through in fume hood sidewall where indicated on the Laboratory Furnishing drawings. Pass-through shall be flanged and sealed on the interior of the fume hood, with a threaded end and cap on the exterior.

E. Bench Mounted Chemical Fume Hoods:

1. Style: General purpose.
 - a. Subject to compliance with the requirements listed below, acceptable models include:
 - 1). G3 Fume Hood by Advanced Lab Concepts.
 - 2). Isolator Bench Fume Hood by Jamestown Metal Products, Inc.
 - 3). Supreme Air Fume Hood by Kewaunee Scientific Corporation.
 - 4). Protector XL Benchtop Laboratory Hood by Labconco Corporation.
 - 5). Pro Restricted Bypass Bench Fume Hood by Mott Manufacturing Limited.
 - 6). SafeAire II Restricted Bypass Fume Hood by Thermo Fisher Scientific.
2. Exterior Depth: 31 ¼ inches (794 mm), nominal. Interior depth: Minimum 23 ½ inches (597 mm) clearance.
3. Design:
 - a. Restricted bypass fume hoods for variable air volume or constant volume exhaust systems with airfoil. Bypass shall be sufficient in size to allow 25% flow with sash closed. Bypass must be achieved through low resistance opening at top of front lintel panel. Bypass shall be designed to provide a smooth down flow effect.
 - b. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20% of the average face velocity at any designated measuring point as defined in this section.
 - 1). Fume hoods shall be designed to operate safely at face velocities of 100 feet per minute (0.51 m/s) to 125 feet per minute (0.64 m/s).
4. Work Surface: 1 ¼ inch (32 mm) dished epoxy resin, in compliance with Section 115310 requirements. Color: Black.
5. Airfoil: The airfoil shall allow ample room for electrical hospital grade cords to fit beneath the airfoil. Sill must pivot forward to provide cord and trough access. Bottom horizontal foil shall provide nominal 1 inch (25.4 mm) bypass when sash is in the closed position. Bottom foil shall not be removable without use of special tools. Airfoil shall be steel with urethane or epoxy powder coating.
 - a. Sill shall consist of a half-round bullnose on front edge. Air foil and sill to be flush with the height of the work surface; airfoil sills that are not flush with the top plane of the work surface dish are not acceptable. A secondary containment trough shall be located in front of the work surface and extend below the airfoil sill.
6. Fume hood sash (Vertical): Full-view, frameless type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections. Sash to have a 35 inch (890 mm), nominal, sight line and a 28 ½ inch (724 mm), nominal, vertical access height.
 - a. Counter balance system: Single weight, counter balance system to prevent sash tilting and permit ease of operation at any point along full width pull. Maximum 7 pounds (3 kg) pull required to raise or lower sash throughout its full length of operating sash opening. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure.
 - b. Sash shall have the capability to be raised to full 28 ½ inch (724 mm), nominal, vertical opening for loading or unloading of large apparatus.
 - c. Sash Stop: To allow manual override with automatic reset for an 18 inch (457 mm) sash opening. Either of the following devices are acceptable:

- 1). Stainless steel spring-loaded barrel-bolt integrated with sash pull and provided with angled stainless steel strike plate.

F. Finish Requirements

1. Preparation:

- a. After the units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish to the metal and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a heated cleaner/phosphate solution and pretreated with iron phosphate spray followed by a neutral final seal prior to application of final finish. The strength of each solution shall be monitored by filtration to insure consistent quality.
- b. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.

2. Application: Electrostatically apply powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:

- a. All surfaces, exterior or interior, exposed to view, shall receive sufficient powder coat to achieve an average 1.5 mil (38 μm) film thickness with a minimum 1.2 mil (30 μm) film thickness and shall have smooth satin luster.
- b. Backs of cabinets and other surfaces not exposed to view shall have sufficient powder coat to achieve an average 1.0 mil (25 μm) film thickness.
- c. Concealed interior parts shall receive corrosion-resistant treatment.
- d. Stainless steel parts and surfaces shall not be powder coated.

3. Chemical Resistance Finish Performance Requirements:

- a. Test Procedure: Apply 10 drops (approximately 0.5 cubic centimeters) of each reagent identified to the surface of the finished test panels laid flat and level on a horizontal surface. Ambient temperature: 68°F to 72°F (20°C to 22°C). After one hour flush away chemicals with cold water and wash surface with detergent and warm water at 150°F (65.5°C) and with alcohol to remove surface stains. Examine surface under 100 foot-candles (1076 lx) of illumination.
- b. Evaluation Ratings: Change in surface finish and function shall be described by the following ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Damage to film and loss of adhesion and film protection. Obvious and significant deterioration.

4. Performance requirements: Test results for powder coat finish shall equal or exceed the following:

Reagent	% by weight	Rating
Acetic acid	50%	1

Reagent	% by weight	Rating
Acetic acid, glacial	98%	1
Acetone	50%	2
Ammonium hydroxide	25%	1
Amyl acetate		1
Benzene		1
Butyl alcohol		1
Carbon tetrachloride		1
Cresol		1
Dimethyl formamide		2
Dioxane		2
Ethyl alcohol		1
Ethyl acetate		2
Ethyl ether		1
Formaldehyde		1
Furfural		2
Gasoline		1
Glycerin		1
Hydrochloric acid	10%	1
Hydrochloric acid	20%	1
Hydrochloric acid	37%	1
Hydrofluoric acid	48%	2
Hydrogen peroxide	30%	1
Kerosene		2
Methyl alcohol		1
Methyl ethyl ketone		2
Monochlorobenzene		1
Naphthalene (dissolved in Toulene)		2
Nitric acid	10%	1
Nitric acid	30%	1
Phenol	85%	2
Phosphoric acid	25%	1
Phosphoric acid	75%	1
Potassium hydroxide	45%	1
Silver nitrate (10% aqueous solution)		1
Sodium carbonate, saturated		1
Sodium chloride, saturated		1
Sodium hydroxide	40%	1
Sodium hydroxide	50%	1
Sodium hypochlorite	5.25%	1
Sodium sulfide, saturated		1
Sulfuric acid	50%	1
Sulfuric acid	70%	1
Tincture of Iodine		2
Toulene		1
Trichloroethylene		2
Xylene		1
Zinc chloride, saturated		1

Note: Maximum concentration is to be understood unless a lower concentration is shown in the table.

a. Physical Tests:

- 1). Abrasion: Finish shall have high abrasion resistance with maximum weight loss of 5.5 mg per 100 cycles as tested on a Taber Abrasion Tester No. E40101 with 1000 gm wheel pressure and Calibrase No. CS10 wheel.
- 2). Hardness: Finish shall have surface hardness equivalent to 4H or 5H pencil lead.
- 3). Humidity: Finish shall withstand 1000 hours exposure in saturated atmosphere at 100°F (38°C).
- 4). Moisture: Finish shall withstand the following procedures with no visible effect:
 - a). Boiling water flowing over 45° inclined surface for 5 minutes.
 - b). 100 hours continuous contact with water-soaked cellulose sponge, maintained in a wet condition throughout test.
- 5). Adhesion: Finish shall withstand the following test procedure with at least 95 squares maintaining their finish. Using a razor blade, score the finish surface of the test panel through to the substrate with a pattern of 100 squares, each 1/16 inch x 1/16 inch. Brush away loose particles with a soft brush.
- 6). Salt spray: Finish shall withstand 200 hours exposure to salt spray test.

G. Fume Hood Liner Test: Polyresin

1. Test No. 1: Spills and Splashes:
 - a. Suspend a 42 inches (1067 mm) x 12 inches (305 mm) panel (42 inch (1067 mm) dimension horizontal) in a position to expose the surface to be tested in a vertical plane. Divide the panel vertically into 3/4 inch (19 mm) spaces.
 - b. Using an eyedropper, apply five drops of each reagent as listed.
 - c. Liquid reagents shall be applied at the top of the panel and permitted to flow down full panel height. (CAUTION! Flush away any reagent drops.)
2. Test No. 2: Fumes and Gases:
 - a. Prepare a panel 24 inches (610 mm) x 12 inches (305 mm) by dividing panel into 2 inch (51 mm) squares. Using 100 ml beakers, place 25 ml (approximately 1/2 inch (13 mm) of reagent) into each beaker. Place beakers in position so that test panel may be placed over beaker tops in the proper sequence. Place panel over beakers. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.
 - b. After a 24 hour time period has elapsed, remove panel, flush off with water, clean with naphtha and detergent, rinse and wipe dry. Evaluate.

3. Evaluating Ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

4. Performance: Test results shall equal or exceed the following:

Reagent	% by wt.	Spills	Fumes
Acetic acid, glacial		0	0
Acetone		0	0

Reagent	% by wt.	Spills	Fumes
Acid dichromate		1	1
Ammonium hydroxide	28%	0	0
Amyl acetate		0	0
Benzene		0	0
Butyl alcohol		0	0
Carbon tetrachloride		0	0
Chloroform		0	0
Chromic acid, saturated		3	0
Cresol		0	0
Dichloro acetic acid	93%	0	0
Dimethyl formamide		0	0
Dioxane		0	0
Ethyl acetate		0	0
Ethyl alcohol		0	0
Ethyl ether		0	0
Formaldehyde	37%	0	0
Formic Acid	88%	0	0
Furfural		2	0
Gasoline		0	0
Hydrochloric acid	48%	1	1
Hydrofluoric acid	37%	0	0
Hydrogen peroxide	30%	0	0
Methyl alcohol		0	0
Methyl ethyl ketone		0	0
Methylene chloride		0	0
Monochlorobenzene		0	0
Naphthalene		0	0
Nitric acid	20%	0	0
Nitric acid	30%	0	0
Nitric acid	70%	0	0
Phenol	85%	0	1
Phosphoric acid	85%	1	0
Silver Nitrate	10%	1	0
Sodium Hydroxide	10%	1	0
Sodium Hydroxide	20%	1	0
Sodium Hydroxide	40%	1	0
Sodium Hydroxide Flake		0	0
Sodium Sulfide, saturated		2	1
Sulfuric acid	33%	1	0
Sulfuric acid	77%	1	0
Sulfuric acid	93%	1	0
Sulfuric acid/Nitric acid, equal parts	77%/70%	0	1
Tincture of Iodine		0	2
Trichloroethylene		0	0
Toluene		0	0
Xylene		0	0
Zinc Chloride		0	0

Note: Maximum concentration is to be understood unless a lower concentration is shown in the table.

2.3 LAMINAR FLOW CLEAN BENCHES

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
1. The Baker Company, Inc., P O Drawer E, Sanford, ME 04073 Tel: 1-800-992-2537.
 1. Labconco Corporation, 8811 Prospect Avenue, Kansas City, MO 64132 Tel: 1-800-821-5525.
 2. NuAire, Inc., 2100 Fernbrook Lane, Plymouth, MN 55447 Tel: 1-800-328-3352.
 3. Approved substitution.
- B. Horizontal Laminar Flow Clean Benches:
1. Basis of Design: Baker EdgeGARD EG, or equal, with the following characteristics or modifications.
 - a. Interior Work Height: 28 inches (710 mm), minimum.
 - b. Interior Work Depth: 22 inches (560 mm), nominal.
 2. Materials:
 - a. Work Surface: 16 gauge (1.6 mm), Type 304 stainless steel, with No. 4 finish.
 - b. Side Walls: 16 gauge (1.6 mm), Type 304 stainless steel, with No. 4 finish, or Plexiglas.
 - c. Cold rolled steel: 18 gauge (1.27 mm). Exterior finish: white baked enamel.
 - d. Glass (if used in construction): ¼ inch (6.35 mm) safety glass. There shall be no permanent etchings on glass.
 3. Construction:
 - a. Cabinet: Work surface and side wall panels, if stainless steel, shall be integral one-piece construction. All metal corners coved. Provide exterior enclosure of cold rolled steel to conceal exposed service piping. Each cabinet component to be welded, gasketed or assembled with air-tight, hermetically sealed joints to provide a gas- and soap bubble-tight sealed assembly.
 - b. Console design with adjustable leg risers for work surface at 36 inches to 38 inches (965 mm) above floor.
 - c. Provide removable, stainless steel screen to protect HEPA filter.
 - d. Provide ½ inch (13 mm) lip at rear of work surface to prevent spills from entering filter.
 4. Features:
 - a. Service Fittings: Where indicated on drawings, provide ball valve fitting with single lever handle mounted on the work area side wall, factory-installed and complete with all gaskets, grommets, and sleeves. Fitting manufacturer shall be the same as providing the Laboratory Fittings specified under Section 115343. Petcock not acceptable.
 - b. Lighting: Level of 200 foot-candles (2152 lx) at the work surface.
 - c. Electrical: Provide one GFI-protected duplex receptacle with stainless steel faceplate externally mounted in front of unit below work surface, connected to a separate circuit breaker. Provide 10 foot (3657 mm) minimum power cord with NEMA 5-20P plug, or pigtail for hard-wire applications.
 - d. Blower: Blower shall automatically provide a constant volume of air, adjusting for increases in resistance due to filter loading, until filter is fully loaded and motor capacity is reached. Average air velocity shall be maintained at 100 feet per minute (0.51 m/s).
 - e. Filters: Front-loading, washable and reusable pre-filters, and front-loading, HEPA supply filter with 99.99% efficiency on all particles 0.3 micron. Filters shall be front-loaded. A neoprene gasket shall provide an airtight seal between the filter assembly and the metal plenum.
 - f. Seismic restraint.

5. Listings:
 - a. Underwriters Laboratories.

2.4 WELDING SNORKEL

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
 1. Nederman LLC, 102 Transit Avenue, Thomasville, NC, 27360 Tel: 800-533-5286.
 2. Movex Inc., 104 Commerce Drive, Suite C, Northampton, PA 18067 Tel: 610 440-0478.
 3. Plymovent Corporation, 375 Raritan Center Parkway, Edison, NJ 08837 Tel: 1-800-644-0911.
 4. Approved substitution.
- B. Models: Subject to compliance with the requirements listed below, acceptable models include:
 1. Extraction Arm Original by Nederman model No. 10554335.
 2. RX Local Extractor by Movex Inc.
 3. MultiSmart Arm by Plymovent Corporation.
- C. Type: Wall mounted, self-supporting fume extractor arm.
- D. Characteristics:
 1. Extractor Arm Diameter:
 - a. 6 inch diameter tubes.
 2. Extractor Arm Material:
 - a. Hose: Double skin flexible hose of PVC-coated woven polyamide with internal steel spiral.
 3. Arm Length: Arms shall be of 3m in length.
 - a. Assembly shall be positioned so that no component is lower than 84 inches above the finished floor.
 4. Swivel Assembly: Hi-grade cast aluminum with 360 degree rotation.
 5. Joints: Friction joints with ball bearings and O-ring.
 - a. Provide external, corrosion-resistant adjustment knobs.
 6. Hood (metal): 10 inch diameter, powder-coated aluminum.
 7. Hood (ESD): 10 inch diameter, anodized aluminum (ESD).
 8. Ceiling mounted stanchion/bracket for attachment to structure above.
 9. Escutcheon suitable to trim any ceiling penetrations.
 10. Final connection to the fume exhaust duct system under Division 23 /15. Provide airflow per Equipment Exhaust Schedule.
 11. Dampers are not acceptable and shall not be provided.

2.5 GAS SAFETY CABINET

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Owner's representative, may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
1. Applied Energy Systems, Inc., Malvern, PA 19355 Tel: 610 647-8744.
 2. Matheson Tri-Gas, 2200 Houston Avenue, Houston, TX 77007 Tel: 713 869-7351.
 3. Praxair, Inc., Oak Brook, IL 60521-2216 Tel: 800 772-9247.
 4. Scott Specialty Gases, Inc., Plumsteadville, PA 18949-0310 Tel: 215 766-8861.
 5. Spectra Gases, Inc., Irvington, NJ 07111 Tel: 800 932-0624.
 6. Approved substitution.
- B. Design:
1. Purpose-designed cylinder gas system cabinet with space for systems that provide precise control and purge gas cylinder for total purging capability.
 2. Fire protection:
 - a. UL approved sprinkler system.
 - b. UV/IR detector for automatic shutdown controller (Pyrophoric gases only).
 3. Door(s): Full-height, self-closing and self-latching door with louvered air intake located at bottom.
 4. Window: 1-hour fire rated approved, 1/4-inch wire reinforced safety glass.
 5. Cabinet shall be securely braced to fixed structure. Individual cylinders shall be braced to cabinet.
 6. Door lock: Cabinet shall be equipped with a keyed lock. All gas safety cabinets shall be keyed alike. Furnish two sets of keys for each cabinet.
 7. Codes and standards: Cabinet shall comply with national and local building and fire codes and OSHA, NFPA and SEMI standard requirements for the safe handling of hazardous gases. Cabinet shall meet Article 80 UFC requirements. All electrical components shall meet Class 1 Division 2 requirements.
 8. Venting: Provide 6-inch diameter duct exhaust collar for connection to exhaust duct system. Connection to exhaust duct system shall be under Division 23.

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Prior to installation of the Work of this Section, carefully inspect the installed Work specified in other sections and verify that all such Work is complete to the point where this installation may properly commence.
- B. Verify that all Work has been installed in complete accordance with the original design, received submittals, and the manufacturer's recommendations.
- C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

- A. Work in this Section requires close coordination with Work specified in Division 22, 23 and Division 26, as well as installation by Owner of Owner furnished components. Coordinate all Work to ensure an orderly process in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.

- B. Coordinate location and alignment of fume hoods and cabinets for proper connection of all piping and duct work.
- C. Install all equipment in accordance with applicable codes and regulations, accepted Shop Drawings, and as necessary for a complete operating system.

3.3 FIELD TESTING

- A. Chemical Fume Hoods:
 - 1. Balance, test and certify each fume hood in accordance with ASHRAE 110-1995 (AI) for Flow Visualization, Face Velocity, and Tracer Gas Containment Testing Requirements.
 - 2. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity and air flow patterns.
 - 3. Fume hoods shall achieve an AI performance rating equal or better than 0.10 ppm with 4.0 Lpm tracer gas release rate when tested in accordance with ASHRAE 110-1995.
 - 4. Balancing of the system is in the scope of work of Division 23.

3.4 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as approved by the Architect upon completion of installation.
- B. Adjust all moving or operating part to function within their design parameters.
- C. Clean equipment, touch up as required.
- D. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.

END OF SECTION 11 5313

SECTION 11 5343 – LABORATORY SERVICE FITTINGS AND FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Laboratory service fittings, valves, and related components.
- B. Laboratory emergency plumbing fixtures.
- C. Laboratory sink units.
- D. Hose reel.

1.2 RELATED SECTIONS

- A. Division 22: Plumbing
- B. Division 23: Heating, Ventilated, and Air-Conditioning
- C. Division 23: Mechanical
- D. Division 26: Electrical

1.3 REFERENCES

- A. Conform to the recommended practices for laboratory service fittings and fixtures published by the Scientific Equipment and Furniture Association, SEFA 7-2007: Laboratory and Hospital Fixtures.

1.4 DESCRIPTION

- A. Work includes but is not necessarily limited to furnishing to the project site for installation by Division 22, all laboratory fixtures, fittings, and emergency plumbing fixtures described herein and shown on the Laboratory Furnishings Drawings.

1.5 SUBMITTALS

- A. Refer to General Conditions and Division 1 “Submittal Procedures” for submittal requirements. In addition to these requirements, provide submittal requirements specified herein.
- B. Submittal requirements:
 - 1. Submittal shall be prepared individually for this specification section. Arrange product data, drawings and information for submission in a complete set for this specification section.
 - 2. Submittal shall contain complete data for all items of this specification section. Periodic or partial submittals of individual components within this specification section will be returned as incomplete and rejected.
 - 3. Submittals shall be organized by specification sequence with section and paragraph number identified.

4. Equipment and components being proposed shall be clearly labeled with all options and accessories indicated and shall be for this specific project.
- C. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for Work in this Section.
- D. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 inches x 17 inches (A3) in size. Blue line prints are not acceptable.
- E. Approved Substitution/Approved Equal: In addition to the items required in Division 1, all substitution requests shall include item-by-item comparison of the proposed substitution to this project specification. A copy of the project specification shall be submitted, with each item and subsection of the project specification marked as "Comply" or "Not Comply." In any cases where "Not Comply" is indicated, an explanation of the relative advantages of the proposed design shall be provided.
 1. Substitution shall not affect dimensions shown on Drawings.
 2. The Contractor shall pay for changes to the building design, including engineering design, detailing, utility and service requirements, and construction costs caused by the requested substitution.
 3. Substitutions shall have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
 4. Maintenance and service parts shall be locally available for the proposed substitution.
- F. Samples: Submit two (2) samples of each type of specified finish and color specified.
- G. Certifications: As a condition of acceptance, submit certification stating that equipment is complete and ready for intended function.
- H. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and closest factory representative for components and service.

1.6 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades.
- B. Replacement: Any damaged work shall be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to the Owner.

1.7 QUALIFICATIONS

- A. Work in this section shall be performed by a company having a minimum of eight years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

- B. Work in this Section requires close coordination with Work in electrical and mechanical Sections. Coordinate all Work to assure an orderly progress in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.
- C. Review conditions of installation, procedures and coordination with related Work.
- D. Carefully inspect the installed Work specified in other Sections and verify that all such Work is complete and ready for the installation of this Work to properly commence.
- E. Verify that all Work may be installed in complete accordance with the original design, reviewed submittals and manufacturer's recommendations.

1.8 WARRANTY

- A. All products will be warranted to be free from defects in materials and workmanship for a period of one year following substantial completion. The manufacturer/dealer/subcontractor shall repair or replace any products (or parts thereof) that are found to be defective. Replacement will include any parts, labor, shipping, and travel expenses involved. Warranty replacement work must be scheduled in coordination with the College's academic schedule and may therefore require evening and/or weekend hours.

PART 2 PRODUCTS

2.1 GENERAL

- A. All service fittings and emergency plumbing fixtures shall be specifically designed for laboratory use.
- B. Service fittings, emergency fixtures, sinks, etc. specified in this Section shall be furnished and delivered to point of use for installation as specified in Division 22.
- C. All service fittings shall be factory pre-assembled including the assembly of valves to turrets, mounting shanks to turrets, etc., and individually factory tested.
- D. All laboratory service fittings shall be the product of one service fitting manufacturer to assure ease of replacement and maintenance.
- E. All service valves, fittings, and accessories shall be of cast brass with a minimum copper content of 85%, except for items which are to be brass forging or bar stock.
- F. Provide fittings as shown in laboratory fitting details for all laboratory equipment at locations shown on the Laboratory Furnishings drawings. See Service Fitting Schedule.
- G. Assembly components and operating parts such as valve stems, renewable units, packing nuts, outlet nozzles and straight serrated hose ends shall be made from solid brass stock.
- H. Replaceable seats, needle cones, valve disc screws and other accessories shall be Monel or stainless steel alloys especially selected for use intended.
- I. Fittings shall be factory tested and shall be supplied with nipples, lock nuts, shanks, etc.

- J. Serrated tip fittings shall have 3/8 inch ((9.525 mm)) IPS thread with the hose end being tapered. Diameter of orifice in serrated tip shall be 1/8 inch (3.2 mm), except where otherwise specified.
- K. Turrets shall be brass drop forging of design indicated in details shown elsewhere in the Section and shall be one or two-way, as required, with 3/8 inch ((9.525 mm)) IPS female inlet thread for connections. Units shall be furnished with brass shanks, brass locknuts, and washers.
- L. Fittings located on the same plane shall have their handles project the same distance from the plane of reference to present a uniform related appearance, regardless of valve type construction.
- M. Flanges shall be brass forging of approved design with 3/8 inch ((9.525 mm)) IPS female inlet and outlet.
- N. All goosenecks shall provide full thread for attachment of anti-splash outlet fittings, serrated tips, and filter pumps.
- O. Hot water/cold water gooseneck mixers and wall-mounted cold water goosenecks shall swivel. Swivel point shall be above valve body or at valve level if wall mounted. Swing joints shall have heavy Teflon type packings; "O" rings will not be permitted. Cold water goosenecks at cup sinks shall be rigid.
- P. All fittings shall have plastic colored service index buttons as specified in this Section.
- Q. Provide approved backflow preventers at hand held drench hoses. See details on Laboratory Furnishings drawings.
- R. Provide durable 1 inch x 3 inch (25 x 75 mm) sign "NONPOTABLE WATER, DO NOT DRINK" at each bench mounted industrial water fitting, see details on Laboratory Furnishings drawings.
- S. Provide plug and socket (2-piece) quick connect service fittings for all compressed air (AIR60-100) fittings.
- T. Fittings and fixtures designated to be accessible to persons with disabilities (ADA) with operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N), maximum.

2.2 LABORATORY SERVICE FITTINGS

- A. Manufacturers:
 - 1. Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
 - a. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: (312) 666-5500.
 - b. T&S Brass and Bronze Works, Inc., 2 Saddleback Cove, P. O. Box 1088, Travelers Rest, SC 29690 Tel: (800) 476-4103.
 - c. Broen represented by Laboratory Enterprises, 3122 Brinkerhoff Rd. Kansas City, KS 66115 Tel: (913) 621-7337.
 - d. Approved substitution.
- B. Pattern: All service fittings shall have cylindrical profiles.

- C. Handles:
1. Faucets designated to be accessible to persons with disabilities (ADA): provide 4" "wrist-blade" handles with screw on index (identification) discs. Wrist-blade handles to be installed in the vertical position (off).
 2. Laboratory gas, air and vacuum valves at workstations indicated to be accessible to persons with disabilities (ADA): Provide ball valves fitted with lever-type handles and screw on index (identification) discs.
 3. Other fittings shall be fitted with four arm handles.
- D. Finish: Satin chrome, with clear, acid-resistant coating.
- E. Water Valves:
1. Water valves shall include a renewable unit containing all the working parts which are subject to wear, including stainless steel or monel seat, monel screw and heavy duty seat disk and Teflon packing, and an integral adjustable volume control.
 2. Unit shall be capable of being readily converted from compression to self-closing, and vice versa, without disturbing faucet body proper and shall also be capable of being readily converted from water construction to needle valve or steam valve construction having outside packing gland without disturbing faucet body.
 3. Unit shall be sealed in valve body with special composition gasket. Metal-to-metal or ground joint type of sealing is not acceptable.
 4. Water fixtures shall be fully assembled and factory tested at 80 psi (0.55 MPa) water pressure.
- F. Needle Valves: Fully assembled and factory tested at 225 psi (1.55 MPa) air pressure. Gas, air, vacuum and steam needle valve fittings shall have stainless steel replaceable floating cone that is precision ground and self-centering which shall seat against a stainless steel or monel renewable valve seat. Action of valve shall be slow compression for fine control under pressure up to 150 psi (1.03 MPa) and shall have subject-to-wear parts easily replaceable. Provide pressure regulators designed for use with the appropriate service at locations indicated on the Laboratory Furnishing drawings. Needle valves for natural (laboratory) gas service shall be certified for use with natural gas by the Canadian Standards Association under ANSI Z21.15-1997/CGA9.1-M97. Needle valves in fume hoods shall be mounted on the front panel of the fume hood, with all components subject to wear accessible from the exterior face of the hood.
- G. Laboratory Ball Valves: Suitable for laboratory gas, air and vacuum and be supplied fully assembled and factory tested at 125 psi (0.86 MPa) air pressure. Ball valves shall be of quarter-turn (closed to fully open) design, be fitted with lever handle requiring less than 5 lbf (22 N) force to operate, and shall have subject-to-wear parts easily replaceable. Ball valves for natural (laboratory) gas service shall be certified for use with natural gas by the Canadian Standards Association under ANSI Z21.15-1997/CGA9.1-M97.
- H. High Purity Water Valves: Suitable for purified water and provided with polypropylene liner. Valve stem and bonnet shall be brass.

I. Service Fitting Color Index:

Service Name	Disc Color	Letters	Letter Color
Lab Air	Orange	AIR	Black
Compressed Air	Orange	AIR60,90,100	White
Gas	Dark Blue	GAS	White
Vacuum	Yellow	VAC	Black

Service Name	Disc Color	Letters	Letter Color
Industrial Cold Water	Dark Green	ICW	White
Industrial Hot Water	Red	IHW	White
Cold Water (Potable)	Dark Green	CW	White
Hot Water (Potable)	Red	HW	White
High Purity Water	White	PW	Black
Deionized Water	White	DI	Black
Argon	Violet	AR	White
Nitrogen	Brown	N2	White
Carbon Dioxide	Pink	CO2	Black
Helium	Black	HE	White
Oxygen	Light Green	O2	Black
CWS/R	Green	CWS/CWR	Black
Steam	Black	STM	White
Sea Water	Dark Green	SEAWAT	White
Cylinder Gas	Light Blue	CYL GAS	Black

2.3 LABORATORY EMERGENCY PLUMBING FIXTURES

- A. Manufacturers:
1. Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
 - a. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610
Tel: 312 666-5500.
 - b. Guardian Equipment, 1104N North Branch St., Chicago, IL 60642 Tel: 312 447-8100.
 - c. Haws Corporation, 1455 Kleppe Lane, Sparks, NV 89431 Tel: 775 359-4712.
 - d. Approved substitution.
- B. All emergency plumbing fixtures shall comply with requirements of ANSI Standard Z358.1-2009: American National Standard for Emergency Eyewash and Shower Equipment.
- C. All emergency plumbing fixtures shall be accessible to persons with disabilities in compliance with the requirements of the federal Americans with Disabilities Act (ADA), ADA Accessibility Guidelines (ADAAG), and state accessibility regulations.
- D. Barrier-free safety station with swing-down eye/face wash and emergency shower activation valve in stainless steel cabinet for recessed mounting: Water Saver Model No. SSBF2170, or equal, with the following characteristics or modifications (Provided in Labs).
1. Wall-mounted, exposed showerhead.
 2. Exposed piping, showerhead, nipple, and escutcheon shall be stainless steel.
 3. Safety shower actuating arm shall be stainless steel.
 4. Showerhead shall have perforated stainless steel spreader.
 5. Eyewash heads shall be ABS plastic.
 6. Eyewash flow shall be activated by swing-down actuation valve connected to eyewash piping.

7. Eyewash components and safety shower actuating arm shall be mounted in a flanged, recessed-mounted 18 gauge (1.3 mm) stainless steel cabinet with No. 4 finish.
 8. Stay-open brass ball valves concealed behind stainless steel/access panel housing.
 9. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.
- E. Barrier-free safety station with swing-down eye/face wash, drain pan and emergency shower actuation valve in stainless steel cabinet for recessed mounting: Water Saver Model No. SSBF2150, or equal, with the following characteristics or modifications (Provided in Clean Room).
1. Ceiling-mounted exposed showerhead. Nipple length shall be as required for a complete installation; verify finished ceiling height.
 2. Exposed piping, showerhead, nipple, and escutcheon shall be chrome-plated brass with clear epoxy coating.
 3. Safety shower actuating arm shall be stainless steel.
 4. Showerhead have perforated stainless steel spreader.
 5. Eyewash heads shall be ABS plastic.
 6. Eyewash flow shall be activated by swing-down actuation valve connected to eyewash piping.
 7. Eyewash components and safety shower actuating arm shall be mounted in a flanged, recessed-mounted 18 gauge (1.3 mm) stainless steel cabinet with No. 4 finish. A stainless steel drain pan shall be integral with eyewash components and shall direct eyewash water to drain outlet in bottom of recessed mounting cabinet.
 8. Stay-open brass ball valves concealed behind stainless steel/access panel housing.
 9. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.
- F. Barrier-free safety station with swing-down eye/face wash, drain pan and emergency shower actuation valve in stainless steel cabinet for surface mounting: Water Saver Model No. SSBF2173, or equal, with the following characteristics or modifications (Provided only in Clean Room).
1. Exposed showerhead.
 2. Exposed piping, showerhead, nipple, and escutcheon shall be brushed stainless steel.
 3. Safety shower actuating arm shall be stainless steel.
 4. Showerhead have perforated stainless steel spreader.
 5. Eyewash heads shall be ABS plastic.
 6. Eyewash flow shall be activated by swing-down actuation valve connected to eyewash piping.
 7. Eyewash components and safety shower actuating arm shall be mounted in a stainless steel cabinet for surface mounting on wall, 16 gauge (1.3 mm) with No. 4 finish. A stainless steel drain pan shall be integral with eyewash components and shall direct eyewash water to drain outlet in bottom of recessed mounting cabinet.
 8. Stay-open brass ball valves concealed behind stainless steel/access panel housing.
 9. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.
- G. Alarm Horn (Provided only in Clean Room): Provide wall-mounted alarm horn with weather proof flow switch at every emergency shower location to sound when the safety shower is activated. Provide additional contacts for wiring to a remote monitoring system. Water Saver Model No. AP280-230, or equal.

2.4 FINISHES

- A. Satin chrome finish with clear, acid-resistant coating:
1. Applicable to:
 - a. All laboratory service fittings (except fittings inside fume hoods).
 - b. All laboratory service fittings mounted on stainless steel work surfaces, scullery sinks, hand or service sinks, or any other stainless steel laboratory furnishing item or equipment.
 - c. Laboratory emergency plumbing fixtures.
 2. Chrome finish: All exposed surfaces shall be polished and buffed, then electroplated with one layer of nickel and one layer of chrome. Each layer of plating shall completely cover all visible areas. Total plating thickness shall be not less than 0.4 mil (10 μm). Finish:
 - a. Satin (AISI No. 6 brushed finish).
 3. Clear epoxy coating: Following plating, clear epoxy coating shall be applied to all exposed surfaces and then baked to permit curing. Surfaces shall have a minimum coating thickness of 2 mils (50 μm).
- B. Colored coating:
1. Fume hood service fittings.
 2. Preparation: Surfaces to be coated shall be polished or sandblasted to produce a uniform fine-grained surface and immersed in a phosphoric acid cleaning solution to remove thoroughly all oil, grease and other foreign substances.
 3. Epoxy finish: Following cleaning, coating material shall be electrostatically applied to all exposed surfaces. After application, coating shall be fully baked to permit curing. Coating material shall be free-flowing epoxy powder with particle size of 1.4 to 2.8 mils (35 to 70 μm). Surfaces shall have a minimum finished coating thickness of 2 mils (50 μm).
 4. Color:
 - a. Fittings inside fume hoods shall have a colored finish color-coded to match the fitting service index color.
- C. Performance requirements for coated finishes:
1. Chemical resistance:
 - a. Fume Test: Suspend coated samples in a container of at least 6 cu. foot (170 L) capacity, approximately 12 inches (300 mm) above open beakers, each containing 100 mL of 70% nitric acid, 94% sulfuric acid and 35% hydrochloric acid, respectively. After exposure to these fumes for 150 hours, the finish on the samples shall show no discoloration, disintegration or other effects.
 - b. Direct Application Test: Subject coated samples to the direct action of the following reagents and solvents at a temperature of 25°C dropping from a burette at the rate of 60 drops per minute for ten minutes. Finish on samples shall not rupture, though slight discoloration or temporary softening is permissible.

Reagent	Concentration
Acetic Acid	98%
Acetone	
Ammonium Hydroxide	28%
Amyl Acetate	
Amyl Alcohol	
Benzene	
Butyl Alcohol	
Calcium Hypochlorite	

Reagent	Concentration
Carbon Disulfide	
Carbon Tetrachloride	
Chloroform	
Chromic Trioxide Acid	
Cresol	
Crude Oil	
Dioxane	
Distilled Water	
Ether	
Ethyl Acetate	
Ethyl Alcohol	
Ethyl Ether	
Formaldehyde	37%
Formic Acid	90%
Gasoline	
Glacial Acetic Acid	99.5%
Glycerine	
Hydrochloric Acid	38%
Hydrofluoric Acid	48%
Hydrogen Peroxide	5%
Isopropyl Alcohol	
Lactic Acid	10%
Kerosene	
Methanol	
Methyl Alcohol	
Methyl Ethyl Ketone	
Methylene Chloride	
Mineral Oil	
Monochlor Benzene	
N-Hexane	
Naphthalene	
Nitric Acid	70%
Perchloric Acid	70%
Phenol	
Phosphoric Acid	75%
Sea Water	
Silver Nitrate	30%
Sodium Bichromate	Saturated
Sodium Carbonate	10%
Sodium Chloride	20%
Sodium Hydroxide	50%
Sodium Hypochlorite	
Sodium Sulfide	
Sulfuric Acid	87%
Toluene	
Trichlorethylene	
Turpentine	
Urea	Saturated
Xylene	
Zinc Chloride	Saturated

2. Mar and abrasion resistance: Coating material shall have a pencil hardness of 2H – 4H with adhesion substantial enough to withstand both direct and reverse impacts of 160 inch-pounds (18 Nm). Coating shall have excellent mar resistance and be capable of withstanding scuffing, marring and other ordinary wear.
3. Repairability: Scratches and other localized surface damage shall be field-repairable.

2.5 LABORATORY SINKS

- A. Epoxy Resin:
 1. Manufacturer: Manufacturer shall be the manufacturer of epoxy resin work surfaces specified in Section 11 53 10.
 2. Laboratory Sinks:
 - a. Drop-in Type: Drop-in installation by Division 11 in epoxy resin work surface. Color to match work surface.
 - b. Comply with the requirements of Section 11 53 10 for epoxy resin.
 - c. All exposed edges shall be radiused not less than 1/4 inch (6 mm).
 - d. Drain grooves in top: Sink shall be set 1/8 inch (3 mm) below the lowest drain groove level.
 - e. Tops without drain grooves: Sink shall be set 1/8 inch (3 mm) below the level of the adjacent surface.
 - f. Provide epoxy resin sink outlet in color to match sink with strainer, stopper and open-end overflow, and install in sink with continuous bead of silicone sealant.
 - 1). At black epoxy resin sinks, outlet shall be black polypropylene.
 - g. Provide tailpiece compatible with waste piping system for all sinks unless otherwise specified. Refer to Division 22 for piping requirements.
 3. Cup Sinks:
 - a. Fume Hood Locations: Provide cup sinks at fume hoods as described in Section 11 53 13.
 - b. Laboratory Work Surface Installations:
 - 1). Raised rim, color to match work surface, sizes as indicated on drawings, with integral threaded tailpiece.
 - 2). Flush with work surface, color to match work surface, sizes as indicated on drawings, with integral outlet and threaded tailpiece. Tailpiece shall be compatible with waste piping system for all sinks unless otherwise specified. Refer to Division 22 for piping requirements.
 - c. Comply with the requirements of Section 11 53 10 for epoxy resin.
 - d. Provide strainer for all cup sinks.
 - e. Provide mounting bracket for wall-mounted cup sinks.
- B. Stainless steel:
 1. Laboratory Sinks:
 - a. Refer to Section 11 53 10, Stainless Steel Fabrications.
 - b. Provide stainless steel strainer, outlet, standpipe overflow and stopper for all sinks unless otherwise specified.
 - c. Provide tailpieces compatible with waste piping system for all sinks unless otherwise specified. Refer to Division 22 for piping requirements.
 2. Cup Sink:
 - a. Fume Hood Locations: Provide cup sinks at fume hoods as described in Section 11 53 13.
 - b. Laboratory Work Surface Installations: Refer to Section 11 53 10, Stainless Steel Fabrications.

- c. Provide strainer, outlet and tailpiece for all cup sinks. Tailpiece shall be compatible with waste piping system for all sinks unless otherwise specified. Refer to Division 22 for piping requirements.
- d. Provide mounting bracket for wall-mounted cup sinks.

2.6 HOSE REEL

- A. Manufacturers: Products that comply with this specification section as judged and approved by the Architect may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
 - 1. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: 312 666-5500.
 - 2. Chicago Faucet Company, 2100 S. Clearwater Drive, Des Plaines, IL 60018 Tel: 847 803-5000.
 - 3. T & S Brass & Bronze Works Inc., PO Box 1088, 2 Saddleback Cove Road, Travelers Rest, SC 29690 Tel: 800 423-0150.
 - 4. Approved substitution.
- B. Description:
 - 1. Wall mounted hose reel, hot and cold water: Water Saver Model HR435MOD, with the following characteristics or modifications:
 - a. Spring retractable hose reel shall be Reelcraft Industries, Inc. Model 5600 OLS with Model 1-HS1004 adjustable hose bumper, or approved equal.
 - 1). Stainless steel construction with electropolished finish.
 - 2). Heavy duty hose bracket with nylon guide rollers.
 - 3). Permanent factory lubricated reel.
 - 4). Weatherproof gasketed spring.
 - 5). Banded drive spring for smooth automatic hose retrieval.
 - 6). Latching mechanism to maintain the desired length of hose.
 - 7). Wall bracket.
 - 8). Solid molded rubber adjustable hose bumper with stainless steel hardware.
 - b. 3/8 inch (9.5 mm) inside diameter hose. Length: 35 feet (10.65 m).
 - c. Shut off valve.
 - d. Vacuum breaker (if potable system).
 - e. Spray nozzle.
 - f. Piping between valve and reel shall be concealed in wall. Exposed piping exiting wall to reel shall be stainless steel.
 - g. Unit shall be design for water temperatures up to 120°F (49°C).
- C. Operation: Hose shall maintain position until a slight tug causes it to retract automatically.

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Inspection:
 - 1. Prior to installation of fittings specified in Section 11 53 43, carefully inspect the installed Work specified in other Sections and verify that all such Work is complete to the point where this installation may properly commence.
 - 2. Verify that all Work has been installed in complete accordance with the original design, approved submittals, and the manufacturer's recommendations.

- B. Discrepancy:
 - 1. In the event of discrepancy, immediately notify the Architect.

3.2 PACKING AND DELIVERY

- A. Deliver all fittings and fixtures to job site in recommended packaging, with each fitting individually packaged, marked, and scheduled for point of use.
- B. Inventory fittings, at job site, verify that type and quantity are correct, and re-package until installed.
- C. Store in clean, dry location.

3.3 INSTALLATION

- A. Set internal volume control on all cup sink water fittings so water does not splash out of sink.

END OF SECTION 11 5343

SECTION 11 5353 – BIOLOGICAL SAFETY CABINETS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Biological safety cabinets

1.2 RELATED SECTIONS

- A. Section 115343: Laboratory Fittings and Fixtures
- B. Division 23: Mechanical
- C. Division 22: Plumbing
- D. Division 23: HVAC

1.3 REFERENCES

- A. NSF/ANSI 49: Class II (Laminar Flow) Biohazard Cabinetry.

1.4 DESCRIPTION

- A. Provide equipment complete with accessories as described herein and shown on Laboratory Furnishings drawings.
- B. Biological safety cabinets with accessories shall be pre-piped and pre-wired. Pre-pipe service fittings to single point connection at 6 inches (150 mm) above top of cabinet or as otherwise shown.
 - a. Refer to Section 115343 and details on Laboratory Furnishings drawings for service fittings.
- C. Work of this Section requires close coordination with Work of Divisions 22, 23 and 26 as well as installation of Owner furnished components and Work specified in other Sections. Sequence all Work to ensure an orderly progress in the project without removal of previously installed Work and so as to prevent damage to finishes and products.

1.5 SUBMITTALS

- A. Refer to the General Conditions and Division 1 “Submittal Procedures” for submittal requirements. In addition to these requirements, provide submittal requirements specified herein.
- B. Submittal requirements:
 - 1. Submittal shall be prepared individually for this specification section. Arrange product data, drawings and information for submission in a complete set for this specification section.
 - 2. Submittal shall contain complete data for all items of this specification section. Periodic or partial submittals of individual components within this specification section will be returned as incomplete and rejected.

3. Submittals shall be organized by specification sequence with section and paragraph number identified.
 4. Equipment and components being proposed shall be clearly labeled with all options and accessories indicated and shall be for this specific project. All non-applicable options, items and components shall be deleted or struck.
- C. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, and products for Work specified in this Section.
- D. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 inches x 17 inches (A3) in size. Blue line prints are not acceptable.
- E. Submit detailed anchorage and attachment detail drawings for seismic restraint.
- F. Samples: Submit two (2) samples of each type of specified finish and color range available.
- G. Test reports: Submit the following performance test reports.
1. Factory Testing: Each unit shall be factory-tested for NSF Class II requirements.
 2. Certification: Submit certification by an independent testing company stating that equipment is installed per applicable and referenced codes and standards, tested, adjusted and balanced for design operations, and is complete and ready for intended function.
 3. Sound Level Certification: Provide certification of biological safety cabinet compliance with design criteria for maximum allowable noise within laboratories. Test data of octave band analysis verifying cabinet is capable of a 50 NC value. Measurements shall be taken 36 inches in front of open sash at 100 fpm face velocity.
- H. Operations/Maintenance Manuals: Submit under provisions of Division 01. Submit for Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, and closest factory representative for components and service.

1.6 QUALIFICATIONS

- A. Work in this Section shall be performed by a firm having a minimum eight years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

1.7 SUBSTITUTIONS

- A. Approved Substitution/Approved Equal: In addition to the items required in Division 1, all substitution requests shall include item-by-item comparison of the proposed substitution to this project specification. A copy of the project specification shall be submitted, with each item and subsection of the project specification marked as "Comply" or "Not Comply." In any cases where "Not Comply" is indicated, an explanation of the relative advantages of the proposed design shall be provided.

- B. Substitution shall not affect dimensions shown on Drawings.
- C. The Contractor shall pay for changes to the building design, including engineering design, detailing, utility and service requirements, and construction costs caused by the requested substitution.
- D. Substitutions shall have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
- E. Maintenance and service parts shall be locally available for the proposed substitution.

PART 2 PRODUCTS

2.1 ACCESSIBILITY FOR PERSONS WITH DISABILITIES

- A. Where indicated on Laboratory Furnishings drawings, biological safety cabinets shall be furnished and installed in a manner to make them accessible to persons with disabilities in accordance with the Americans with Disabilities Act and any state or local building code or regulation having jurisdiction. The height of the highest point of access to the work surface above finished floor shall not exceed 34 inches. Fittings for piped services and electrical receptacles shall be of a design and in a location in order to be considered accessible.

2.2 BIOLOGICAL SAFETY CABINETS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.
 - 1. The Baker Company, Inc., P.O. Drawer E, Sanford, ME 04073 Tel: 800 992-2537.
 - 2. Kewaunee Scientific Corporation, P.O. Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
 - 3. Labconco Corporation, 8811 Prospect Avenue, Kansas City, MO 64132 Tel: 800 821-5525.
 - 4. NuAire, Inc., 2100 Fernbrook Lane, Plymouth, MN 55447 Tel: 800 328-3352.
 - 5. Thermo Fisher Scientific, P.O. Box 649, Marietta, OH 45750 Tel: 740 373-4763.
 - 6. Approved substitution.
- B. Class II, Type B2 Vertical Laminar Flow Biological Safety Cabinets
 - 1. Subject to compliance with the requirements listed below, acceptable models include:
 - a. SterilchemGARD III Advance by the Baker Company.
 - b. Purifier Logic Class II, Type B2 by Labconco Corporation.
 - c. Labgard NU-430 by Nuair, Inc.
 - d. Thermo Scientific 1400 Series B2 by Thermo Fisher Scientific.
 - 2. Features:
 - a. 100% of air filtered and exhausted from common plenum to fume exhaust system.
 - b. Interior Work Height: 29 ¼ inches (743 mm), nominal.
 - c. Overall Height: 99 ¼ inches (2520 mm), nominal.
 - 3. Materials:
 - a. Work Surface: 16 gauge (1.6 mm), Type 304 stainless steel, with No. 4 finish.
 - b. Liner: 14 gauge (2.0 mm), Type 304 stainless steel, with No. 4 finish.
 - c. Cold rolled steel: 12 gauge (2.64 mm) and 14 gauge (2.0 mm). Exterior finish: white baked enamel.

- d. Glass: 1/4 inch (6.35 mm) safety glass. There shall be no permanent etchings on glass.
 - e. Piping: Comply with Division 22 requirements for piping and installation requirements for respective pre-piped services.
4. Construction:
- a. Cabinet: Work surface and interior wall and rear panels shall be integral one-piece construction. All corners coved. Provide exterior removable side panels and enclosure of cold rolled steel to conceal exposed service piping. Each cabinet component to be welded, gasketed or assembled with air-tight, hermetically sealed joints to provide a gas- and soap bubble-tight sealed assembly.
 - b. All biologically contaminated ducts, plenum, and work area side walls shall be permanent metal construction and maintained under negative pressure or enclosed within a negative pressure zone.
 - c. Provide high velocity return air slots at each end of the front access opening.
 - d. Base:
 - 1). Console base.
 - e. Work Surface Height:
 - 1). Work surface shall be set at 34 inches (863 mm) above floor for console base installation.
 - f. Screen Style: Vertical sliding viewscreen. Full-open viewscreen shall be 19 1/2 inches (495 mm) high for equipment access and cleaning.
 - 1). Access Opening: 8 inches (203 mm) access opening with face velocity of 100 to 110 fpm.
 - g. Airfoil: Airfoil should be provided at lower front work area to improve access opening containment capability.
 - h. Drain Pan: Provide stainless steel ball valve for effective drainage of drain pan.
 - i. Provide stainless steel air diffuser and filter protector in work area.
 - j. Provide automatic blower motor speed control to compensate for changing resistance of exhaust and supply filters to maintain nominal air volume setpoints.
5. Features:
- a. Access Opening Alarm: Provide audible alarm to sound when viewscreen is above its proper operating access opening height.
 - b. Service Fittings: Provide ball valve fitting with single lever handle mounted on the work area side wall, factory-installed and complete with all gaskets, grommets, and sleeves. Fitting manufacturer shall be the same as providing the Laboratory Fittings specified under Section 115343. Petcock not acceptable. .
Lighting: Level of 100 foot-candles (1076 lx) at the work surface.
 - c. Lighting: Provide light levels of 80 foot-candles at the work surface.
 - d. Electrical: Provide one GFI-protected duplex receptacle with covers and stainless steel faceplate in each sidewall, connected to a separate circuit breaker. Provide 12 foot minimum power cord with NEMA 5-20P plug.
 - e. Blower motor: Provide a variable speed, digital ECM-controlled DC motor.
 - f. Airtight damper: Provide stainless steel exhaust duct section with manual controlled stainless steel air tight damper assembly to prevent leakage of gas during decontamination of cabinet including flexible boots and clamping rings for connection to the fume exhaust duct system by Division 23.
 - g. Filters: Front-loading, HEPA 99.99%, efficient on all particles 0.3 micron by DOP test (both exhaust and supply). Filters shall be front-loaded. A neoprene gasket shall provide an airtight seal between the filter assembly and the metal plenum.
 - h. Exhaust: Refer to Exhaust Schedule on drawings.

- 1). Exhaust Connection: Provide hard-ducted exhaust connection device/boot. Connection to the fume exhaust ductwork shall be by Division 23. Refer to Laboratory Furnishings drawings for size and locations.
- 2). Airflow Rate Alarm: Provide audible and visual alarm if the mass airflow in the duct should decrease below the set rate.
- i. Control panel shall be digital microprocessor-type and include:
 - 1). Control functions shall be centered at eye-level.
 - 2). Monitor and display airflow system performance through dual thermister probes.
 - 3). Control blower, lights, and receptacles with solid state membrane switches.
 - 4). Digital control of blower motor to compensate for changing resistance of supply and exhaust filters in order to maintain nominal air volume set points.
 - 5). Alarm set point high/low for error conditions.
 - 6). Clock display (24 hour) and timer function.
 - 7). UV light timer (if UV light is included).
 - 8). Remote contacts and interlock features.
 - 9). Complete diagnostic functions.
- j. Adjustable, stainless steel foot rest.
- k. Ergonomic stainless steel armrest, either integral with the airfoil sill or removable.
- l. Germicidal ultraviolet light with UV light interlock, allowing UV illumination only when sash is fully closed.
- m. Flexible duct connection shall allow for work surface height adjustment within specified range, and without the use of tools. Flexible duct connection shall be attached to thimble device and be connected to ductwork under Division 23 work.
- n. Flexible hose connection(s) shall allow for work surface height adjustment within specified range, and without the use of tools. Flexible hose connection(s) shall be attached to cabinet factory-installed piping and be connected to building piping under Division 22 work.
- o. Seismic restraint.

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Prior to installation of the Work of this Section, carefully inspect the installed Work specified in other sections and verify that all such Work is complete to the point where this installation may properly commence.
- B. Verify that all Work has been installed in complete accordance with the original design, received submittals, and the manufacturer's recommendations.
- C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

- A. Work in this Section requires close coordination with Work specified in Division 22, 23 and Division 26, as well as installation by Owner of Owner furnished components. Coordinate all Work to ensure an orderly process in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.
- B. Coordinate location and alignment of biological safety cabinets for proper connection of all piping and duct work.
- C. Install all equipment in accordance with applicable codes and regulations, accepted Shop Drawings, and as necessary for a complete operating system.

3.3 FIELD TESTING

- A. Balance, test and certify each biological safety cabinet in accordance with Annex F Field Tests appended to National Sanitation Foundation (NSF) Standard 49 "Class II (Laminar Flow) Biohazard Cabinetry".
- B. Biological safety cabinet field tests shall be performed by an independent NSF-accredited testing company.
- C. Balancing of the building exhaust system is in the scope of work of Division 23.

3.4 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as approved by the Architect upon completion of installation.
- B. Adjust all moving or operating part to function within their design parameters.
- C. Clean equipment, touch up as required.
- D. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.

END OF SECTION 11 5353

SECTION 12 2113

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes horizontal metal slat louver blinds and operating hardware at the following locations:
 - 1. Exterior windows at laboratories.
 - 2. Exterior windows at offices and conference rooms, except where motorized shades are scheduled.
 - 3. Interior office windows facing atrium on Levels 2,3 and 4.
 - 4. Refer to Schedule for room numbers.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 06 1053 - Miscellaneous Rough Carpentry: Blocking for attachment of headrail brackets.

1.2 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- C. Product Data: Submit data indicating physical and dimensional characteristics, and operating features.
- D. Samples: Submit two samples, minimum 4 inches long, illustrating slat materials, finish and color.
- E. Manufacturer's Installation Instructions:

1.3 SUSTAINABLE DESIGN SUBMITTALS

- A. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post consumer and preconsumer recycled content.
 - 1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
 - 2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight; include materials cost only.
 - 4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

-
- B. Local / Regional Materials: For materials that have been extracted or harvested, processed and manufactured within 500 miles of project site.
1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
 2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.4 QUALIFICATIONS

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

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.6 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with window installation and placement of concealed blocking to support blinds.

PART 2 PRODUCTS

2.1 HORIZONTAL LOUVER BLINDS

- A. Manufacturers:
1. Bali Window Treatments.
 2. Graber Window Treatments.
 3. Hunter Douglas Window Fashions.
 4. Levolor Contract.
 5. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.2 COMPONENTS

- A. Basis of Design: Levelor Contract, Model # MARK1.
- B. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by cord.

-
- C. Metal Slats: Spring tempered pre-finished aluminum, radiused slat corners, with manufacturing burrs removed.
 - 1. Width: 1 inch.
 - 2. Thickness: Nominal 0.008 inch.
 - 3. Spacing between Slats: Between 20 mm and 22.5 mm.
 - 4. Slats:
 - a. Unperforated at exterior windows.
 - b. Perforated at interior locations facing atrium; staggered pattern of .020" diameter holes with an openness factor of 6%.
 - 5. Color: As selected from manufacturers standard colors.
 - D. Slat Support: Braided polyester yarn in ladder configuration.
 - E. Head Rail: Pre-finished, formed .025 inch thick steel, valance-free with end caps; internally fitted with hardware, pulleys, and bearings for operation; 1-1/2" high x 1-5/8" wide with a crowned underside profile to prevent light leakage.
 - 1. Color: Same as slats.
 - F. Bottom Rail: Bottom rail shall be of .029" thick pre-finished steel and shall be fully enclosed with color compatible flexible bottom bumper and polyethylene end caps designed to prevent bottom rail from marring window sill and/or mullions. End caps shall provide hold-down capability designed to prevent bottom bar sway on doors or in windy exposures.
 - 1. Color: Same as slats.
 - G. Tilt Wand shall be solid, clear, transparent polymer with a round cross section 5/16" in diameter. The tilt wand mechanism shall exit the bottom of the headrail via a U-shaped black steel link.
 - H. Lift / Control Cords: High strength braided polyester fiber in continuous loop.
 - 1. Free end weighted.
 - 2. Color: As selected from manufacturers' standard colors.
 - I. Headrail Attachment: Ceiling brackets for mounting to gypsum board.
 - J. Accessory Hardware: Type recommended by blind manufacturer.

2.3 FABRICATION

- A. Fabricate blinds to fit within openings with uniform edge clearance of 1/2 inch.
- B. At openings requiring multiple blind units, fabricate separate blind assemblies with space of 1/4 inch between assemblies, occurring at window mullion centers.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

- B. Verify openings are ready to receive work.
- C. Verify blocking and supports are correctly placed.

3.2 INSTALLATION

- A. Install blinds.
- B. Secure in place with concealed fasteners.

3.3 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
- C. Maximum Offset From Level: 1/8 inch.

3.4 ADJUSTING

- A. Section 01 7000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust blinds for smooth operation.

3.5 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Final cleaning.
- B. Clean blind surfaces just prior to occupancy.

3.6 SCHEDULE

- A. Provide solid slat blinds at the following rooms:
 - 1. First Floor: 1-144, 1-146, 1-152, 1-156.
 - 2. Second Floor: 2-108, 2-112, 2-114, 2-116, 2-118, 2-120 (west end), 2-122, 2-124, 2-126, 2-128, 2-132, 2-134, 2-136, 2-140, 2-142, 2-144, 2-146, 2-146B, 2-152, 2-164 and 2-166.
 - 3. Third Floor: 3-108, 2-112, 3-114, 3-116, 3-118, 3-120 (west end), 3-124, 3-128, 3-132, 3-136, 3-154, 3-164, 3-166, 3-174, 3-174C, 3-176, and 3-178.
 - 4. Fourth Floor: 4-108, 4-112, 4-114, 4-116, 4-118, 4-124, 4-128, 4-132, 4-136, 4-154, 4-154C, 4-164, 4-166, 4-172, 4-174, and 4-176.
- B. Provide perforated slat blinds at the following rooms:
 - 1. Second Floor: 2-113, 2-117, 2-121, 2-125 and 2-131.
 - 2. Third Floor: 3-117, 3-121, 3-123, 3-127, 3-131, 3-133, and 3-135.
 - 3. Fourth Floor: 4-117, 4-121, 4-123, 4-127, 4-131, 4-133, and 4-135.

END OF SECTION

SECTION 12 2413

ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. Manually operated room-darkening shades for Room 3-164.
 - 2. Electrically operated room-darkening shades for Rooms 1-102, 1-106, 1-108, and 2-107.
- B. Related Sections:
 - 1. Section 06100 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.
 - 3. Section 09510 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.
 - 4. Division 16 - Electrical: Electric service for motor controls.

1.2 REFERENCES

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2005.
- C. NFPA 70 National Electrical Code.
- D. NFPA 701, Small Scale Test.

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: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
 - 1. Motorized Shade Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - 2. Wiring Diagrams: Power, system, motor, motor controller and wiring.

- C. Samples for Verification:
 - 1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated include valance
 - 2. For the following products:
 - a. Shade Materials: Not less than 12 inches square, with specified treatments applied of each. Mark face of material.
- D. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
- E. Product Certificates: For each type of roller shade, signed by product manufacturer.
- F. Qualification Data: For Installer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of roller shade.
- H. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining roller shades and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - 3. Operating hardware.
 - 4. Motorized shade operator.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section
- 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, as determined by testing identical products per test method indicated below 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, and marked for intended use.
- E. Product Standard: Provide roller shades complying with WCMA A 100.1.
- F. Mockups: Build to verify selections made under submittals, to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Mockup one set of shades of each type.
 - 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, fire-test-response characteristics, 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 roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- 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 glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. Motorized Roller Shade Hardware, and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.
- C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed owners responsibility.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Mecho Shade equipment listed is used as the standard for components, features and construction.
 - 1. Manual Shades: Mecho/5
 - a. Mounting: Surface mounted with fascia.
 - b. Configuration: Single blackout shadecloth.
 - 2. Motorized Shades: ElectroShade System, Electro/1.
 - a. Mounting: Surface mounted with pocket enclosure.
 - b. Configuration: Single roll.
- B. Other Acceptable Manufacturers (unless noted otherwise):
 - 1. Substitutions: Under provisions of Section 016000 - Product Requirements.

2.2 SYSTEM REQUIREMENTS

- A. Requirements for Roller Shade Installer/Contractor:
 - 1. Provide roller shade hardware, shade fabric, motor, and all related controls as a complete assembly.
 - 2. Provide all electrical and electronic controls and accessories required for a complete control system including appropriate interface to communicate with AV system as required.

2.3 DESCRIPTION

- A. Roller shade consisting of a single or double 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: Non corrodible 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 as follows, measured at 74 deg F:
 - 1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
- D. Mounting: Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without damaging roller shade or adjacent surfaces and finishes or requiring removal of brackets regardless of mounting position (inside or outside mount).

2.4 ROLLER SHADES

- A. Rollers:
 - 1. Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter.
 - 2. Wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging.
- B. Shade Cloth – Blackout
 - 1. Room Darkening Shadecloth: MechoShade Systems, Inc., Thermoveil Equinox 0100 Series; PVC-free blackout material and weighing 0.94 lbs. per square yard, comprising of 53 percent fiberglass, 45 percent acrylic, 2 percent poly finish.
- C. Shade Cloth – Room Darkening
 - 1. Basis of Design: Ecoveil 1550 Series, PVC-free.
 - 2. Fabric Width: As indicated on Drawings.
 - 3. Colors: As selected by Architect from manufacturer's full range.
 - 4. Material Openness Factor: 3 percent.
 - 5. Bottom Hem: Straight.
 - 6. Trim: As indicated by manufacturer's designation for style and color.
 - 7. Fringe: As indicated by manufacturer's designation for style and color.

- D. Direction of Roll: Regular, from back of roller.
- E. Mounting Brackets: Galvanized or zinc-plated steel.
- F. Intermediate Roller couplers and brackets: Galvanized or zinc-plated steel.
- G. Pocket-Style Head box: 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 an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.
- H. Hembar: Steel or extruded aluminum
- I. Side Channels for blackout curtains: Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening
- J. Valance: Continuous removable extruded aluminum valance that attaches to shade mounting brackets without the use of adhesives magnetic strips or exposed fasteners
- K. Installation Fasteners: No 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 under conditions of normal use.

2.5 MANUAL OPERATORS

- A. Manual Shade Operator: Continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.
 - 1. Position of Clutch Operator: As indicated on Drawings.
 - 2. Roller Idler Assembly and clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
 - 3. Lift-Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
 - 4. Loop Length: Length required to make operation convenient from floor level.
 - 5. Bead Chain: Nickel-plated metal.
 - 6. Cord Tensioner Mounting: Wall.
 - 7. Operating Function: Stop and hold shade at any position in ascending or descending travel.

2.6 MOTORIZED ROLLER SHADE OPERATORS

- A. Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated.
 - 1. Provide operation systems complete with electric motors and factory-prewired motor controls, wireless remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls, and all operating parts and accessories required for reliable operation without malfunction.
 - 2. Include wiring from motor controls to motors.

3. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
 4. Motor Coupler: Provide for motorized shades where more than one shade is motorized; machined from solid aluminum 6063-T5 stock, sized to roller, attached at each motor to allow ease of installation and service of motor.
 5. Roller Idler Assembly for Motorized Shades: Spring-loaded pin for ease of installation; high strength ball joint with self-aligning bearing.
 6. Comply with NFPA 70.
- B. 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.
- C. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, 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 Mounting: Within manufacturer's standard roller enclosure.
- D. Position of Motor and Electrical Connection: Left side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
- E. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for surface mounting. Provide the following devices for remote-control activation of shades:
1. Individual/Group Control Stations: -contact, three-position, rocker-style, wall switch-operated control station with open, close, and center off functions for individual and group control.
 - a. Color: White.
 - b. Product: Subject to compliance with requirements, provide "Decora Plus" by Leviton Manufacturing Co. Inc. White.
- F. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.
- G. Operating Function: Stop and hold shade at any position.
- H. Operating Features: Include the following:
1. Group switching with integrated switch control; single face plate for multiple switch cut-outs.

2.7 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 Clear or colored anodic coating not less than 0.7 mils thick; color as scheduled
- B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as scheduled.

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 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 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. Allow proper clearances for window operation hardware.
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- D. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 MOTORIZED SYSTEM INSTALLATION

- A. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
 - 1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
 - 2. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.

3. Roller shade installer/dealer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
 4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
 5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.
- B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), design and installation from the sub-panel downstream shall be provided by the roller shade installer/dealer.

3.5 ADJUSTING

- A. Coordinate the following:
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
1. Provide power panels and circuits of sufficient size to accommodate roller shade requirements, indicate on the mechanical and electrical drawings.
 2. Coordinate with requirements of this section, before inaccessible areas are constructed.
- C. An unguided roller shade fabric shall roll true and straight, without shifting sideways more than 1/8" in either direction due to warp distortion, weave design or mechanical misalignment.
1. Run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes or at sub panels in locations as shown on electrical drawings. if not shown assume that home runs go back to nearest shown sub panel.
 2. Provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/control locations designated by the Architect. All above-ceiling and concealed wiring shall be installed in conduit, and as required by the electrical code having jurisdiction.

3.6 CLEANING AND PROTECTION

- A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
 - 1. Contractor shall provide conduit with pull wire in all areas, which might not be accessible at time on installation due to building design, equipment location or schedule.
- B. 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.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 01 Section Demonstration and Training."

3.8 SCHEDULE

- A. See Reflected Ceiling Plans for locations and details of shades.
- B. Motorized (Rooms 1-102, 1-106, 1-108, and 2-107):
 - 1. Motorized interior room darkening roller shades with blackout fabric with related motor control systems.
 - 2. Single roll configuration with fascia and closure trim between window frame and roller.
- C. Manual (Room 3-164):
 - 1. Single roll configuration blackout shade cloth with removable fascia and end caps, room darkening side channels and wall mount brackets.

END OF SECTION

SECTION 12 9300

SITE FURNISHINGS

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. Bicycle racks.
 - 2. Bicycle storage lockers
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installation of pipe sleeves cast in concrete footings.
 - 2. Division 31 Section "Earth Moving" for excavation for installation of concrete footings.
- C. Products furnished, but not installed under this Section, include pipe sleeves to be cast in concrete footings

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For units with factory-applied color finishes.
- C. Product Schedule: For site furnishings. Use same designations indicated on Drawings..
- D. Maintenance Data: For site furnishings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of site furnishing(s) through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel and Iron: Free of surface blemishes and complying with the following:
 - 1. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53, or electric-resistance-welded pipe complying with ASTM A 135.
- B. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard
- C. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; recommended in writing by manufacturer, for exterior applications.
- D. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.
- E. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
 - 1. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.2 BICYCLE RACKS

- A. Manufacturer: Dero Bike Racks
- B. Bicycle Rack Style:
 - 1. Style: Swerve bicycle rack
- C. Steel Finish: Color coated
 - 1. Color: As selected by Architect from manufacturer's full range

2.3 BICYCLE STORAGE LOCKERS

- A. Products: Subject to compliance with requirements, provide the following
- B. Manufacturer: CycleSafe or approved Equal
- C. Model: Propark Series, Standard Model (SM) Modular interlocking Double sided stalls for two bikes

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

3.3 CLEANING

- A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 129300

SECTION 13 5900

SHIELDED ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

- A. The general requirements for the design, construction, erection, and testing of RF shielded enclosures.
- B. Related Sections:
 - 1. Section 09 6536 – Static Control Resilient Flooring:: Rubber floor tile (SDRT-1)
 - 2. Division 23: Mechanical HVAC work related to enclosure.
 - 3. Division 26: Electrical work related to enclosure.
 - 4. Division 27: Communications work related to enclosure.

1.2 SYSTEM DESCRIPTION

- A. Shielded Enclosures: Manufactured modular room enclosure designed to protect space from specified electromagnetic interference when tested in accordance with any of the following standards: IEEE-299, MIL STD 285, EN50147 part 1 and NSA 65-6.
- B. Enclosure: Panelized system, fully enclosed on six sides, including all connections and accessories as required in room descriptions below.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate enclosure layout, details, dimensions, interface with adjoining work, and components.
- C. Product Data: Submit manufacturer's data on wall panels, feed throughs, light fixtures, doors and hardware.
- D. Manufacturer's Certificate: Certify enclosures meet or exceed specified requirements.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum ten years documented experience.

1.5 PRE-INSTALLATION MEETING

- A. Section 01 3000 - Administrative Requirements: Preinstallation meeting.

- B. Convene minimum one week prior to commencing Work of this section.

1.6 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with construction of partitions, electrical and data systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
1. Panashield
 2. Braden Shielding
 3. ETS-Lindgren
 4. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.1 SHEILED ROOM REQUIREMENTS

- A. Specifications for Room 3-171B:
1. Target attenuation of 100 dB (10 kHz - 100 kHz)
 2. Provide shield material to provide the electric field attenuation per the requirements above.
 3. Size: As noted on Drawings (approximately 10' x 10' x 8' high)
 4. Door: 3' x 7' door, shielded to same attenuation specification as walls.
 5. Feed-Through: Provide small panels where noted on Drawings for feed-throughs of AC power (110 V with EMI filters) and data cabling.
 6. Integrated ground stud and RF filters.
 7. Floor Finish: Static dissipative resilient tile SDRT-1. Refer to Section 09 0502 for product.
 8. Light Fixtures: LED fixtures (hookups by Division 26).
- B. Specifications for Room 4-164A:
1. Target attenuation of 80 dB 100 kHz - 10 GHz (electrical) and 40 dB 20 kHz (magnetic)
 2. Provide shield material to provide the electric and magnetic field attenuation per the requirements above.
 3. Size: As noted on Drawings (approximately 10' x 10' x 8' high)
 4. Door: 3' x 7' door, shielded to same attenuation specification as walls.
 5. Feed-Through: Provide small panels where noted on Drawings for feed-throughs of AC power (110 V with EMI filters) and data cabling.
 6. Integrated ground stud and RF filters
 7. Light Fixtures: LED fixtures (hookups by Division 26)
 8. Floor Finish: Static dissipative resilient tile SDRT-1. Refer to Section 09 0502 for product.

2.2 ACCESSORIES

- A. Vapor Retarder: 6 mil poly vapor retarder for application over structural concrete floor.

- B. Underlayment: 1/8 inch hardboard.
- C. Air Inlets: Provided by Division 23.

2.3 FABRICATION

- A. Panels: Galvanized steel sheets laminated to 19mm thick solid core material.
- B. Mechanically joined together with 3 mm thick framing members roll formed into shapes to provide uniform clamping pressure along panel edges without the use of weld nut, serrations or gaskets.
- C. Hardware: Manufacturers standard.
- D. Ramp: Provide fabricated metal ramp for transitioning from raised floor of enclosure to structural floor.

2.4 SHOP FINISHING

- A. Prefinished Surfaces: Color as selected from manufacturer's standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify building partitions are ready to receive work and opening dimensions are as indicated on shop drawings.
- C. Verify the enclosure assembly site is clean, dry and free of obstructions and metallic surfaces that may make contact to the erected enclosure are isolated or removed.
- D. Verify the floor surface on which the enclosure will rest is clean, free of irregularities and level to within 1/8 in in 10 feet.
- E. Verify utility outlets and devices and items penetrating enclosure are coordinated and ready for installation.

3.2 INSTALLATION

- A. Install vapor barrier and underlayment over footprint of enclosure.
- B. Install with clearance between the enclosures and surrounding building partitions is 3 inches if available.
- C. Install RF enclosure so there is no physical contact between shielding materials and building construction.
- D. Install all components and accessories.

- E. Coordinate installation of mechanical diffusers.
- F. Coordinate installation of flooring with Division 9 flooring installer.

3.3 ENCLOSURE PROTECTION

- A. Maintain room free of any water or moisture intrusion.
- B. Do not allow unauthorized or non-approved connections or attachments to the enclosure.
- C. Ensure that no penetrations of the enclosure occur. If the enclosure is inadvertently penetrated, contact supplier for remedial repairs.

3.4 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Provide full testing service for installed rooms, including qualified test engineers and required test equipment to confirm enclosures meet the specified shielding requirements.

END OF SECTION

SECTION 14 6300

TOP RUNNING BRIDGE CRANES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes labor, materials and services to design, fabricate, and install a ten (10) ton capacity single girder, top running bridge crane system for the High Bay.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 1200 – Structural Steel: Securing crane to building steel structure.
 - 3. Division 26 - Electrical: Disconnect switches and wiring.

1.2 REFERENCES

- A. Crane Manufacturers Association of America (CMAA)
 - 1. Specification No. 74 for Top Running & Under Running Single Girder Electric Overhead Traveling Cranes.NFPA-70 - National Electric Code (N.E.C.).
- B. American National Standard (ANSI)
 - 1. ANSI B30.11 - Safety Standard for Monorails and Underhung Cranes.
 - 2. ANSI MH27.1 - Specifications for Underhung Cranes and Monorail Systems.
 - 3. ANSI B30.16 - Safety Standard for Overhead Hoists, HMI Standard.
 - 4. ANSI/ASME HST-4M - Performance Standards for Overhead Electric Wire Rope Hoists.
- C. American Institute of Steel Construction (AISC)
 - 1. Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings
- D. American Welding Society (AWS)
 - 1. D1.1 Code for Welding in Building Construction.
 - 2. D14.1 - American Welding Society Specifications for Welding Industrial and Mill Cranes.
- E. Occupational Safety and Health Administration (OSHA).
 - 1. Par. 1910.179 Overhead & Gantry Cranes.

1.3 SYSTEM DESCRIPTION

- A. Provide a single girder, top running bridge crane system conforming to the following criteria:
 - 1. Capacity: Ten (10) tons.
 - 2. Service Class: All equipment shall be designed for minimum CMAA “Class C” (Moderate Service) as specified in the ANSI MH27.1 Specifications, and operation in normal ambient temperatures (0 to 40 C) and normal indoor conditions, free from excessive dust, moisture and corrosive fumes.

3. Span: Refer to Drawings.
 4. Bridge Girder Deflection: $L/450$.
 5. Bridge Speed: 60 fpm.
 6. Hoist Speed: 10 fpm.
 7. Trolley Speed: 45 fpm.
 8. Electrical Service Provided: 480 volt, 3 phase, 60 hertz.
- B. Hoists, trolleys, bridge end trucks, drives and controls shall all be from only one supplier and shall meet the requirements of this specification.

1.4 SUBMITTALS

- A. Submittals: Under provisions of Section 01 3300.
- B. Shop Drawings
1. Shop Drawings showing complete details, dimensions, and material for fabrication and erection.
 2. Include member sizes, model numbers, specifications, reactions and complete shop and field notes such as welding symbols, paint requirements, bolt sizes, etc.
- C. Product Data
1. Provide information on all components, sub-assemblies, control systems, mechanical features, etc. relating to the equipment supplied under this specification.
 2. Include brochures, catalog cuts, parts breakdowns, operation and maintenance manuals, clearance diagrams, dimensional data (not supplied in the shop drawings) and any other data necessary to determine compliance with specifications.
- D. Design Calculations: Submit calculations and related details prepared, sealed, and signed by registered design professional licensed to practice structural engineering in the State of Minnesota.
1. Include calculations and details for loadings and stresses for all metal fabrications.
 2. Indicate locations, sizes, welding, fasteners, and reinforcing. Unless noted otherwise on Structural Drawings, design loads shall be as prescribed under applicable building code.
- E. Wiring Diagrams
1. Provide complete, integrated wiring diagrams for all the equipment provided under this specification on crane supplier's letterhead. Catalog cuts will not be acceptable.

1.5 QUALITY ASSURANCE

- A. Crane suppliers shall have documented experience of ten (10) years, having successfully designed and built installations of similar scope.

- B. Materials: All materials shall be new, and the completed overhead handling system shall be essentially the product of one crane manufacturer regularly engaged in the production of such equipment.
- C. The bridge crane, trolley and hoist shall have labels on each specifying manufacturer, serial number, and capacity. Lettering shall be a minimum 3" high.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect all equipment against the elements during shipment. If equipment sits outside, it must be protected in such a way as to prevent rust.
- B. Unloading and storage of crane shall be under the direct supervision of manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers include the following:
 - 1. Demag Cranes and Components.
 - 2. Konecranes.
 - 3. Stahl Crane System.
 - 4. Uesco
 - 5. Whiting Corporation.
 - 6. Substitutions: Under provisions of Section 01 6000.

2.2 MATERIALS

- A. All materials shall be new and meet the requirements of CMAA, HMI, NEC and NSI. All load bearing parts shall have a 5:1 factor of safety.
- B. Structural steel used in the fabrication of bridge girders and end trucks shall be new and meet the minimum ASTM standards.

2.3 RUNWAY ELECTRIFICATION

- A. The runway conductors shall be Figure-8, rolled galvanized steel bar. The minimum capacity of the conductor bar shall be sized to carry the necessary ampere load without undue heating.
- B. A four conductor configuration shall be provided with all brackets, hangers, splice covers, power feeds, expansion gap assemblies and collectors as required by Duct-o-wire.
- C. When Variable Frequency Drives are provided, tandem collector shoes shall be provided.

2.4 RUNWAY BEAMS AND RAILS

- A. Runway beams shall be designed to meet the requirements of AISC. Beams, bracing, end stops, and electrification brackets shall be supplied by the crane manufacturer.
- B. Beam sizes, connection details, bracing, etc., shall be clearly shown on the stamped design drawings submitted by the crane supplier. The top flange of the runway beams will be braced to the building structure at each support point
- C. Rails shall be ASCE rails, sized according to the crane wheel loads. Rails, splice bars and bolts shall be supplied by the crane supplier.
- D. The runway rails shall be attached to the runway beams using hook bolts, rail clips or clamps, as determined by the crane supplier.

2.5 BRIDGE CRANE

- A. Crane Girder
 - 1. Girders shall be designed to resist all vertical, horizontal and torsional forces.
 - 2. Bridge girders shall be new, ASTM A992 Hot Rolled structural steel shapes designed to meet the requirements of CMAA.
- B. End trucks
 - 1. End trucks shall be constructed of structural steel tubes, providing a rigid structure. Design shall allow easy wheel removal and exchange.
 - 2. End trucks shall be fitted with shock absorbing bumpers.
 - 3. Crane wheels shall be high strength ductile iron, machined with double flanges and straight treads, flame hardened to 300 Bn. Wheels shall be sized to meet the minimum allowable wheel loads per CMAA. The wheel axle assembly shall rotate on dual high quality anti-friction, lifetime lubricated bearings having a minimum life of 5,000 hours.
 - 4. The end truck to girder connection shall be bolted for easy removal of end truck. Bridge girder shall be coped to provide the highest possible positioning of the runway beams.
- C. Bridge and Trolley Drives
 - 1. Bridge drives shall employ fixed axles with totally enclosed motors. Trolleys shall employ two drive wheels.
 - 2. Motors shall be TENV, Class F insulated with a temperature activated switch in the windings, 30 minute rated, 1800 RPM.
 - 3. The gear reducers shall be fully enclosed with oil bath for gears
- D. The bridge shall consist of a single girder fabricated of structural steel sections, reinforces as needed to provide a rigid frame.

2.6 WIRE ROPE HOIST

- A. Hoist Motor and Braking System
 - 1. Hoist motor shall develop sufficient power to lift the rated load at the specified speed. Motors shall be TENV, Class F insulated with a temperature activated

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- switch, 30 minute rated, 1800 RPM. Hoist motor shall not be placed inside of hoist drum.
 2. The hoist shall have a DC rectified disc type motor brake. Brake material shall not contain asbestos.
- B. Hoist Gearing
1. Hoist gearing shall be helical, heat treated alloy steel and shall operate in an oil bath.
- C. Hoist Drum and Rope
1. The rope drum shall be welded construction, deep grooved and precision machined to give maximum rope life. Drum shall be supported at each end by sealed anti-friction bearings.
 2. The hoisting rope shall be of a proper design and construction for hoist service. The rated capacity load divided by the number of parts of rope shall not exceed 20% of the breaking strength of the rope.
 3. Double wrapping of the rope shall not be permitted. A drum rope guide shall be provided. A minimum of two wraps shall remain on the drum with the hook in the lowest position.
 4. Bottom block shall have a totally enclosed housing fabricated of steel. The rope sheaves shall be supported on an anti-friction thrust bearing. Hook shall be a single barbed type hook as supplied by Crosby and shall be equipped with a heavy spring safety latch.
 5. Hoist shall be equipped with upper and lower limit switches as well as a redundant block operated upper limit switch. The switches shall be adjustable to set the extreme upper and lower limits of hook travel.
 6. Hoist shall be equipped with an overload device to prevent lifting loads in excess of 125%.

2.7 BRIDGE ELECTRIFICATION AND CONTROLS

- A. Electrification
1. To supply the electrical power across the crane for bridge, trolley and hoist motions, a flat cable festoon system shall be utilized. The flat cable shall be extra flexible with color coded wires according to NEMA standards. Wire shall be stranded copper per CMAA.
 2. The trolleys that carry the flat cable shall have steel wheels with sealed ball bearings. The c-track that the trolley operates in shall be a minimum of 14 gage galvanized metal.
 3. Flat cable connectors shall be heat shrinkable, corrosion resistant and flame retardant
- B. Controls
1. Bridge, trolley and hoist controls shall be mounted in NEMA 4 enclosures.
 2. A magnetic mainline contactor, controlled by momentary on/off switches on the pushbutton shall be included.
 3. A control transformer shall be provided with separate and isolated primary and secondary winding, all copper wound. Control voltage shall not exceed 120 volts.
 4. Trolley and hoist functions shall be controlled by separate magnetic contactors.

5. Bridge functions shall be controlled by a variable frequency drive.
 6. All controls shall be sized to meet ambient temperatures. A cooling system will be provided for each enclosure when the ambient temperature exceeds the maximum allowable operating temperature of the individual electrical components.
- C. Radio Controller
1. Primary means of crane operation shall be by remote radio control operator.
 2. Supply two remotes for Owner's use.
- D. Pendant Station
1. Secondary /back-up means of crane operation.
 2. A NEMA 4, pendant station will be provided with a separate pushbutton for each direction. A red mushroom head "off" switch and a separate "on" switch shall be supplied. Operators shall be two-speed.
 3. The enclosures shall have durable, clearly marked legend plates, guards to protect switches from damage or accidental actuation and shall allow for right or left hand operation.

2.8 PAINTING

- A. All structural steel shall be cleaned of rust and mill scale with a minimum SSPC-6 "commercial blast" cleaning.
- B. Cranes shall be painted with 2.0 mil DFT Primer & 2.5- 3.0 mil DFT Safety Yellow Industrial Enamel.
- C. Hoists shall be painted per the Hoist manufacturer's standard coating. Hooks shall not be painted.
- D. Structural components shall be painted with 2.0 mil DFT Primer & 2.5-3.0 mil DFT Gray Industrial Enamel.

2.9 SAFETY DEVICES

- A. Each crane will be provided with all safety devices required by federal, state or local law.
- B. Each Crane will be provided with a capacity plate with 3 inch high letters on each side of the crane giving the capacity in tons.
- C. Cranes shall be supplied with a readily accessible power disconnect on the bridge, adjacent to or part of the control panel.

PART 3 EXECUTION

3.1 SHIPPING

- A. After factory tests are completed, disassemble the crane into major components for shipment with all major points of attachment match-marked to facilitate final

assembly, and all exposed finished parts coated with compound before shipment. Properly pack all small parts in boxes with parts identification clearly marked on the outside of each box.

- B. Crane manufacturer shall replace all parts of the cranes that are damaged or lost in shipment without cost to the Owner.

3.2 CRANE ERECTION

- A. The crane supplier shall receive, unload, and erect the cranes in accordance with applicable codes and specifications.
- B. Installers shall be employees of the supplier and have ten years' experience installing overhead cranes.
- C. Holes shall not be drilled or flame cut in any part of trusses or other parts of the building structure without permission from the customer's Engineer of Record (EOR).
- D. Final electrical hookup to be provided by crane manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Test.
 - 1. Conduct testing for final acceptance after the erection work has advanced to the point that inspection and testing can proceed without interruption. A manufacturer's representative shall be present during testing. Testing costs are the responsibility of the crane installer.
 - 2. Allow inspection of all parts of the crane containing electrical parts or moving mechanical parts.
 - 3. Test the cranes for capacity, speed and deflections in the presence of the owner with 125 percent of the hoist capacity load on the hook. Test weights shall be supplied by crane supplier.
 - 4. Crane supplier will transmit to the owner a certificate of load test and compliance with OSHA requirements.

END OF SECTION

SECTION 14 6310

MONORAIL CRANES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes labor, materials and services to design, fabricate, and install two-ton capacity manually operated monorail cranes and chain hoists.
- B. Related Sections:
 - 1. Section 01 8113 – Sustainable Design Requirements.
 - 2. Section 05 1200 – Structural Steel: Securing crane to building steel structure.
 - 3. Division 26 - Electrical: Disconnect switches and wiring.

1.2 REFERENCES

- A. Crane Manufacturers Association of America (CMAA)
 - 1. Specification No. 74 for Top Running & Under Running Single Girder Electric Overhead Traveling Cranes.NFPA-70 - National Electric Code (N.E.C.).
- B. American National Standard (ANSI)
 - 1. ANSI B30.11 - Safety Standard for Monorails and Underhung Cranes.
 - 2. ANSI MH27.1 - Specifications for Underhung Cranes and Monorail Systems.
 - 3. ANSI B30.16 - Safety Standard for Overhead Hoists, HMI Standard.
 - 4. ANSI/ASME HST-4M - Performance Standards for Overhead Electric Wire Rope Hoists.
- C. American Institute of Steel Construction (AISC)
 - 1. Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings
- D. American Welding Society (AWS)
 - 1. D1.1 Code for Welding in Building Construction.
 - 2. D14.1 - American Welding Society Specifications for Welding Industrial and Mill Cranes.
- E. Occupational Safety and Health Administration (OSHA).
 - 1. Par. 1910.179 Overhead & Gantry Cranes.

1.3 SYSTEM DESCRIPTION

- A. Provide a manually operated monorail crane system conforming to the following criteria:
 - 1. Capacity: Two (2) tons.
 - 2. Service Class: All equipment shall be designed for minimum CMAA “Class C” (Moderate Service) as specified in the ANSI MH27.1 Specifications, and operation in normal ambient temperatures (0 to 40 C) and normal indoor conditions, free from excessive dust, moisture and corrosive fumes.

3. Span: Refer to Drawings.
- B. Hoists, trolleys, bridge end trucks, drives and controls shall all be from only one supplier and shall meet the requirements of this specification.

1.4 SUBMITTALS

- A. Submittals: Under provisions of Section 01 3300.
- B. Shop Drawings
 1. Shop Drawings showing complete details, dimensions, and material for fabrication and erection.
- C. Product Data
 1. Provide information on all components, sub-assemblies, control systems, mechanical features, etc. relating to the equipment supplied under this specification.
- D. Design Calculations: Submit calculations and related details prepared, sealed, and signed by registered design professional licensed to practice structural engineering in the State of Minnesota.
 1. Indicate locations, sizes, welding, fasteners, and reinforcing. Unless noted otherwise on Structural Drawings, design loads shall be as prescribed under applicable building code.

1.5 QUALITY ASSURANCE

- A. Crane suppliers shall have documented experience of ten (10) years, having successfully designed and built installations of similar scope.
- B. Materials: All materials shall be new, and the completed overhead handling system shall be essentially the product of one crane manufacturer regularly engaged in the production of such equipment.
- C. The monorail shall have labels on each specifying manufacturer, serial number, and capacity. Lettering shall be a minimum 3" high.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect all equipment against the elements during shipment. If equipment sits outside, it must be protected in such a way as to prevent rust.
- B. Unloading and storage of crane shall be under the direct supervision of manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers include the following:
 1. Basis of Design: TC/American 325L Series.

2. Cleveland Tramrail
3. US Crane and Hoist
4. Acco-Louden
5. Substitutions: Under provisions of Section 01 6000.

2.2 MATERIALS

- A. All materials shall be new and meet the requirements of CMAA, HMI, NEC and NSI. All load bearing parts shall have a 5:1 factor of safety.
- B. Structural steel used in the fabrication of bridge girders and end trucks shall be new and meet the minimum ASTM standards.

2.3 RUNWAY BEAMS

- A. Runway beams shall be designed to meet the requirements of AISC.
- B. Beam sizes, connection details, bracing, etc., shall be clearly shown on the stamped design drawings submitted by the crane supplier. The top flange of the runway beams will be braced to the building structure at each support point

2.4 MONORAIL

- A. Track: The track shall consist of a specially fabricated section with a special rolled bottom section to accommodate trolley wheels. Track shall be straight with saw cut ends. No rough-cut or torched ends will be permitted. Hole shall be factory punched or drilled
 1. The total rack deflection shall not exceed $1/450$ of the span or 1-1/4", whichever is the least.
 2. Track end stops shall be of the bolted type and shall be capable of withstanding the impact of a fully loaded crane or carrier traveling at 50% of the rated full load speed.
 3. Standard structural shapes or modifications of structural shapes will not be accepted as meeting the requirements.
 4. Track sections shall be installed with bolted type splice plates to provide flush and level connections at the operating tread of the track. The maximum gap between the adjacent ends at load carrying flange not to exceed 1/16"
- B. Track Suspension (where indicated on Drawings)
 1. All necessary clamps, hanger rods, bolts and other fittings from which the track system is suspended, shall be provided as part of the overhead track system.
 2. Means shall be provided, on flexible type rod suspensions, to allow for minimum 1" vertical adjustment of the track both before and after the system has been put in operation so that the track can be erected and maintained level.
 3. Where track system is suspended from flexible type rod suspensions, the system shall be braced laterally and longitudinally to prevent excessive sway. It is necessary to brace only one track laterally. Both tracks shall be braced longitudinally. All bracing is to be provided and installed by the crane erector.

- C. Trolleys
 - 1. Trolley shall have flat tread wheels made from high alloy forged steel. The wheel tread shall be accurately machined to assure concentricity of axle and tread and hardened to 425-480 Brinell. Wheel treads shall be unpainted.

2.5 HOISTS

- A. Monorail supplier shall furnish as part of their contract a hoist of the type most suitable for the particular application under consideration.
- B. Hoists and appurtenances shall be designed to withstand all stresses imposed under safe operating conditions while handling loads within the rated capacity.
- C. Bottom block shall be completely shrouded for safety and fabricated from steel. Hooks are to be forged steel supported by anti-friction thrust bearings and permit 360° rotation. Hooks shall be equipped with latches to bridge the opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions.

2.6 MANUAL HAND CHAIN HOISTS

- A. Chain block lifting device operated by hand chain, secured to structure above (fixed in place) to meet ANSI B30.16-2003 requirements.
 - 1. Load Capacity: 2 tons.
- B. Components shall include hand chain, hand wheel, brake, gear shaft, disc gear, pinion shaft, spline gear, chain sprocket and load chain.

2.7 PAINTING

- A. All structural steel shall be cleaned of rust and mill scale with a minimum SSPC-6 “commercial blast” cleaning.
- B. Hoists shall be painted per the Hoist manufacturer’s standard coating. Hooks shall not be painted.

2.8 SAFETY DEVICES

- A. Each crane will be provided with all safety devices required by federal, state or local law.
- B. Each Crane will be provided with a capacity plate with 3 inch high letters on each side of the crane giving the capacity in tons.

PART 3 EXECUTION

3.1 MONORAIL ERECTION

- A. The supplier shall receive, unload, and erect the monorail in accordance with Drawings and applicable codes and specifications.

- B. Holes shall not be drilled or flame cut in any part of trusses or other parts of the building structure without permission from the customer's Engineer of Record (EOR).

3.2 FIELD QUALITY CONTROL

- A. Acceptance Test.
 - 1. Test the cranes for capacity, speed and deflections in the presence of the owner with 125 percent of the hoist capacity load on the hook. Test weights shall be supplied by crane supplier.
 - 2. Crane supplier will transmit to the owner a certificate of load test and compliance with OSHA requirements.

END OF SECTION

SECTION 32 0180

DESIGN-BUILD IRRIGATION SYSTEM

PART 1 GENERAL

- 1.01 CONDITIONS. The General Conditions and Division 1 General Requirements apply to all work under this section.
- 1.02 SCOPE. Design, furnish, install and service a complete, automatic underground irrigation system that will allow integration with the University of Minnesota's Sentinel Central Irrigation Control System. Irrigation shall start at the designated supply stub, outside the building and downstream of the backflow preventer installed by others, providing 100% watering coverage of all plantings and lawns within the limits shown on the drawings, and 12" rotors spaced 100' o.c. at all seeded grass planting areas. The system design shall be capable of watering the entire area designated within an 8-hour period. The system shall be capable of expansion. Supply shop drawings to landscape architect prior to installation. Instruct the owner, in person and in written form, as to the proper operation and maintenance of the total system. Supply as built drawings of irrigation system. Winterize the system the first fall and start the system the following spring.
- 1.03 SUBMITTALS. Following acceptance of proposal, provide the following information for review and approval.
- A. Submit complete design drawings showing 100% head to head coverage of the lawn areas and quick coupler locations for all perennial planting beds, shrub beds, and grass planting areas with pipe layout and sizes, sprinkler head locations and effective watering radii, controller location and quick coupler valves.
 - B. Design calculations showing source size in GPM, PSI and pressure losses to the farthest zone. All calculations and design shall be based on a maximum flow rate of 4' per second.
 - C. Manufacturer's product data.
- 1.04 QUALITY ASSURANCE. Contractor responsible for irrigation system installation should be familiar with the Toro Sentinel Controller system. Contractor must have experience installing at least one Sentinel system prior to working on this project.

PART 2 PRODUCTS AND MATERIALS

- 2.01 MANUFACTURERS. Equipment manufactured by Toro or Hunter.
- 2.02 MATERIALS.
- A. All materials shall be new, of first class quality and designed for the intended use.
 - B. The reduced pressure, double check-valve type backflow preventer in the building and downstream piping to 5' outside the building will be installed under another contract.
 - C. Exterior Shut-off: Include an exterior shut-off valve adjacent to the water source location for emergency system shut-down. Verify additional isolation valve quantity and locations with U of M Landcare Dept.
 - D. The pressurized irrigation water supply main shall be 200 PSI, SDR 26 PVC piping with a minimum diameter of 2". The main piping shall be sized to allow for future expansion of the system.
 - E. Flow Sensor: Include Data Industrial flow sensor. Install per mfr's requirements.

- F. Zone valves shall be properly sized, Hunter PGV series. Hunter PGV Jar-Top preferred for 1" valve installation. Zone valves shall be housed in NDS pro series valve boxes—Master Valve: Include Hunter 2" ICV master valve. Zone valves shall be properly sized, Hunter ICV series. Hunter ICV preferred for 1" valve installation. Zone valves shall be housed in Carson valve boxes, minimum 10" round, with the zone number permanently marked on the cover.
- G. Lateral zone irrigation piping shall be 100 PSI, NSF rated polyethylene piping, assembled with barbed nylon fittings and two stainless steel clamps spaced ½ ".
- H. The controller shall be Toro Sentinel wall mounted controller on the building exterior. Verify controller location with Landcare.
- I. Provide one handheld maintenance remote controller delivered to the U of M Landcare Dept.
- J. Ground Plate: Specify Paige #182199 plate with #6 bare copper wire. Install per mfr's requirements. Contractor to verify grounded to <10ohms.
- K. Brass quick coupler valves shall be ¾ ", each with a coupler key, each attached to 1 #12 rebar sunk 18" into grade.
- L. Piping under pavement shall be installed in Class 200PVC sleeves – sleeve shall be a minimum of two sizes larger than pipe contained. Place control wire(s) in separate 1 ½" sleeve. Sleeves required for control wire to enter the building will be installed by others.
- M. Control wire shall be 14-gauge solid copper. All wire must meet Underwriters Laboratory approval for direct burial with waterproof connections.
- N. Sprinkler heads shall be Hunter except as follows: specify Toro 570 series heads in lieu of Hunter spray heads. Six (6) extra heads of each type shall be provided to the owner.

PART 3 EXECUTION

3.01 SYSTEM DESIGN.

- A. Design system and prepare drawing and specifications for review and installation. System shall not exceed manufacturer's recommendations and shall provide head-to-head coverage of all turf grass areas with no overspray into adjacent plantings. The irrigation design shall include everything necessary to the proper operation of said irrigation system.
- B. It is the intent to hide all electric remote valve boxes from view.
- C. Drawings shall show locations and types of all sprinkler heads and equipment along with information as to watering area of each component, pipe locations and sizing, precipitation rates and flow rates. Specifications shall indicate detailed information for all products and maintenance procedures.
- D. Submit system design for review and approval to landscape architect prior to installation. Any discrepancies between the irrigation specifications and the irrigation shop drawings must be brought to the attention of the owner before installation.

3.02 SYSTEM INSTALLATION.

- A. Before installation, Contractor must visit the site to confirm locations of all existing elements relative to diagrammatic design components on irrigation shop drawings.
- B. A copy of the approved drawing shall be on-site during any work.
- C. All equipment shall be located flagged prior to any work.
- D. Gopher State One Call (GSOC) shall have been notified 48 hours prior to work and the GSOC ticket number shall be on-site and available to all workers during all work.

- E. Locations of equipment and/or any changes shall be approved by the Landscape Architect prior to work.
- F. All materials shall be installed in a workman-like manner in accordance with the approved drawings and specifications.
- G. Piping shall be securely capped at all times prior to final assembly of fittings and equipment.
- H. Control wire shall be installed with the pressure main with minimum of 36" loops at each valve location.
- I. PVC pressure main piping shall be assembled and allowed to cure in dry conditions when the air temperature is above 40 degrees F, in strict accordance with the manufacturer's recommendations prior to testing.
- J. Install the pressure main in an open trench, 18" deep, free of rock, stones or rubble.
- K. Air test PVC main piping according to manufacturer's recommendations. If leaks are detected, they shall be repaired and the line re-tested until satisfactory. The Landscape Architect must verify a successful air test.
- L. Following a successful air-test, backfill the main pipe trench in 6" lifts with suitable clean fill and compact to the point of no subsidence. Pulling PVC pipe will not be permitted.
- M. Install the proper size zone piping to a minimum depth 10" according to the drawing. Pulling pipe will be permitted.
- N. Install valves and valve boxes. Place brick/paver supports at all valve box locations.
- O. Prior to installing sprinkler heads, flush lateral lines with a full head of water.
- P. Install the sprinkler heads and equipment
- Q. Securely mount the controller in the building where indicated. Others will provide the controller an electrical outlet for operation.

3.03 SYSTEM OPERATION

- A. Demonstrate to the Landscape Architect and the Owner that the system meets coverage requirements and that the automatic controls function properly,
- B. Furnish an "as-built" drawing in AutoCAD format with the name, address and phone number of this installer which shows identifies and locates all piping and equipment.
- C. A plastic covered, mounted copy of the "as-built" drawing shall be installed in the controller.
- D. Instruct the Owner as to the proper operation and maintenance of the system.
- E. This system shall be fully guaranteed for a period of one year after acceptance by the Owner. This installer shall promptly repair or replace any part of this system, including all materials and/or workmanship, which fails to perform and function correctly.
- F. Prior to the first winter after acceptance and no later than October 15, this installer shall be winterize the system using compressed air.
- G. This installer shall put this system back into operation the following spring.
- H. Contractor is responsible for proper operation of irrigation system through the guarantee period of 1 year. If field adjustments are required after installation, Contractor shall make adjustments at no additional cost to the owner.

END OF SECTION

SECTION 32 1123
AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aggregate base course.

1.2 RELATED SECTIONS

- A. Section 31 22 00 – Grading
- B. Section 31 2323 - Fill
- C. Section 31 2316.13 - Trenching
- D. Section 32 1313 - Concrete Paving

1.3 REFERENCES

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; American Association of State Highway and Transportation Officials; 1965 (2000).
- B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18 in Drop; American Association of State Highway and Transportation Officials; 2001.
- C. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2005.
- D. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³); 2000a.
- E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (12,400 ft-lbf/ft³); 2002.
- F. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
- G. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³); 2002.
- H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
- I. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2004.

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- J. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2004.
 - K. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2000.
 - L. Minnesota Department of Transportation Standard Specifications for Construction, 2005 Edition and Corresponding Supplements.

1.4 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures.
- B. Samples: 10 lb sample of each type of aggregate; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used must be submitted prior to construction to Civil Engineer for shop drawing review.
- E. Compaction Density Test Reports must be submitted on a weekly basis. See Section 31 2200-Grading.

1.5 PROJECT CONDITIONS

- A. Provide sufficient quantities of aggregate to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When aggregate materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.
- D. Refer to 31 1000 Site Clearing for additional information.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Coarse Aggregate Class V per MNDOT Standard Specification Section 2211 and 3138.
 - 1. Within Areas of Underground Infiltration System or adjacent to Infiltration Areas: Recycled Class V is not allowed within 10' of the perimeter of the system.
- B. Sand subbase layer shall follow MnDOT Specification 3149.2B2 for Select Granular Borrow modified such that the material has less than 5% passing the #200 sieve and less than 40% passing the #40 sieve.

2.2 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D 2487 classification, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.
- E. Salvage crushed concrete is not allowed in areas where perforated drainage pipes are placed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate has been inspected by a Geotechnical Engineer or qualified representative of the Independent Laboratory, gradients and elevations are correct, and is dry.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.
- C. Prior to placement of aggregate base, perform proof roll with fully loaded tandem axle truck and observed by a Geotechnical Engineer. Correct any soft or weak areas prior to placing aggregate. See Section 31 2200 Grading and 31 2316 Excavation.

3.3 INSTALLATION

- A. Spread sand subbase layer as recommended in the geotechnical report and per geotechnical engineer. This layer shall extend to three feet below finished elevation.
- B. Spread aggregate over prepared substrate to a total compacted thickness as indicated on drawings.
- C. Place aggregate in maximum 3 inch layers and compact to specified density per Section 31 2323 - Fill.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

- G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

- A. Flatness: Maximum variation of 1/8 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/8 inch.
- C. Variation from Design Elevation: Within 1/8 inch.

3.5 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Testing and compaction testing will be performed on compacted aggregate base course in accordance with Sections 31 2200 Grading and 31 2323 Fill.
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.6 CLEAN-UP

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 32 1216

ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Bituminous concrete paving.
- B. Surface sealer.

1.2 RELATED SECTIONS

- A. Section 31 2323 - Fill
- B. Section 32 1123 - Aggregate Base Courses

1.3 REFERENCES

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994, Sixth Edition.
- B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute; Third Edition.
- C. ASTM D 946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Reapproved 1999).
- D. Minnesota Department of Transportation Standard Specifications for Construction, 2005 Edition and Corresponding Supplements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Minnesota Department of Transportation Standards.
- B. Mixing Plant: Conform to State of Minnesota Department of Transportation Standards.
- C. Obtain materials from same source throughout.
- D. Submit shop drawings of aggregate base and bituminous mix designs prior to construction.
- E. Mix plant and mix designs to be MnDOT certified.

1.5 SUBMITTALS

- A. Product data: Within 10 calendar days after Contractor has received the Owner's Notice to Proceed, submit for review and approval:

1. Asphalt Cement Concrete mix design. The proposed mixture shall be an established mix formulated within the past year. If a current mix is not available, a new mix should be designed and tested at Contractor's expense.
2. Certificates, signed by the aggregate materials producer and Contractor stating that materials meet or exceed the specified requirements. Cost of necessary testing to be paid for by Contractor.

1.6 REGULATORY REQUIREMENTS

- A. Conform to City of Minneapolis for paving work on City property.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. 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.
- B. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of loading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Asphalt Cement: ASTM D 946.
- B. Aggregate for Base Course: See Section 32 1123 – Aggregate Base Course.
- C. Tack Coat: Homogeneous, medium curing, liquid asphalt. In accordance with State of Minnesota Department of Transportation Standards Specification Section 2357.

2.2 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Binder Course: Per MnDOT Specification Section 2360 – See details on drawing for mix design.
- C. Wearing Course: Per MnDOT Specification Section 2360 – See details on drawing for mix design.
- D. Submit proposed mix design of each class of mix for review prior to beginning of work.
- E. Contractor shall provide one sample of in-place mixture for each days construction for laboratory testing to ensure conformance with MnDOT specifications.

2.3 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify gradients and elevations of base are correct.
- B. Verify testing of base course has been performed and has met specifications.

3.2 BASE COURSE

- A. See Section 32 1123 Aggregate Base Courses.

3.3 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions and MnDOT Specification Section 2357.
- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate per MnDOT standards.
- C. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT

- A. Place asphalt binder course within 24 hours of applying tack coat.
- B. Place binder course to compacted thickness as shown on plans.
- C. Place wearing course within two hours of placing and compacting binder course.
- D. Place wearing course to compacted thickness as shown on plans.
- E. Install gutter drainage grilles and frames in correct position and elevation.
- F. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- G. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.5 TOLERANCES

- A. Flatness: Maximum variation of 1/8 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Within 1/8 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/8 inch.

3.6 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for quality control.
- B. Owner shall secure and pay for the services of an Independent Testing Laboratory to conduct the pavement testing program.
- C. A qualified representative of the testing laboratory shall be present at the site during the performance of the work required under this Section. Contractor shall notify testing laboratory a minimum of two days in advance of required testing and shall coordinate with Engineer.
- D. The following tests shall be performed:
 - 1. Nuclear field density tests.
 - 2. Marshall density tests.
 - 3. Bituminous extraction and mechanical analysis of aggregate.
- E. Any surface depressions will be water tested by testing the depression one hour after wetting by placing one nickel coin flatwise in ponded area. Where water covers coins, the area will be outlined and shall be removed and redone at contractor's expense.
- F. Quality of pavement shall be such that there is no raveling, uneven roller marks, depressions as noted in 3.7.E or unsmooth abutments to adjacent gutters, curbs, concrete pavement and manhole/catchbasin castings. Any pavement that does not meet the quality standards as determined by the Owner and Architect shall be removed and replaced at the contractor's sole expense.
- G. Clean and sweep excess bituminous rock and spray from any concrete surfaces or landscaping immediately after placement.
- H. Excess oil spray shall be scrubbed clean of any adjoining structure or adjacent concrete surface.

3.7 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for five days or until surface temperature is less than 140 degrees F (60 degrees C).

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, integral curbs, curbs, gutters, pedestrian ramps, parking areas and roads.

1.2 RELATED SECTIONS

- A. Conditions of contract and divisions 0 and 1 govern work of this section.
- B. Section 31 2323 - Fill
- C. Section 32 1123 - Aggregate Base Courses
- D. Section 03 3000 – Cast-in-Place Concrete

1.3 REFERENCES

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 1999.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- D. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1999.
- E. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 1988.
- F. ASTM A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2002.
- G. ASTM A 497/A 497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2002.
- H. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2004b.
- I. ASTM C 33 - Standard Specification for Concrete Aggregates; 2003.
- J. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2004a.
- K. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2004a.
- L. ASTM C 150 - Standard Specification for Portland Cement; 2004a.

- M. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2001.
- N. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2001.
- O. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2003.
- P. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2004.
- Q. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2003.
- R. ASTM C 685/C 685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2001.
- S. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types); 2004.

1.4 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures.
- B. Product Data: Provide data on joint filler, admixtures, and curing compound.
- C. Provide shop drawings on concrete mix design.
- D. Provide sample of Type 2 / E-conc-2 crushed granite to Architect and Engineer prior to work.
- E. Provide three (3) 5'x5' mock ups of Type 2 / E-Conc-2 concrete paving. Each mock up shall have varying degrees of micro etching surface retarders for finishing. Mock ups shall be reviewed and final finishing selected by Architect prior to installation of any Type 2 / E-Conc-2 paving.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Obtain cementitious materials from same source throughout.
- C. Follow recommendations of ACI 305R when concreting during hot weather.
- D. Follow recommendations of ACI 306R when concreting during cold weather.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. 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 FORM MATERIALS

- A. Form Materials: Conform to ACI 347 Formwork for Concrete recommendations unless otherwise specified.
- B. Wood form material, profiled to suit conditions. See Section 03 3000 Reinforced Concrete.
- C. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751).
 - 1. Thickness: 1/2 inch (12 mm).

2.2 REINFORCEMENT

- A. Reinforcing Steel and Welded Wire Reinforcement will not be used in sidewalks or curb and gutter unless specified on drawings.

2.3 CONCRETE MATERIALS

- A. Concrete Materials: Provide in accordance with City of Minneapolis and State of Minnesota Highways standards.
- B. Cement: ASTM C 150 Normal - Type I Portland type, low alkali.
 - 1. Type 1 / E-Conc-1 (per paving plan): standard grey color
 - 2. Type 2 / E-Conc-2 (per paving plan): Scofield CROMIX #1266 (Cool Grey) integral colorant
- C. Aggregate, general:
 - 1. ASTM C30, uniformly graded and clean.
 - 2. Do not use aggregate known to cause excessive shrinkage.
- D. Aggregate, coarse:
 - 1. Type 1 / E-Conc-1 (per paving plan): Crushed rock or washed gravel with maximum size between 3/4" and 1 1/2", and with minimum size #4.
 - 2. Type 2 / E-Conc-2 (per paving plan): Crushed granite with maximum size 3/4" and with minimum size #4.
- E. Aggregate, fine: Clean, natural washed sand of hard and durable particles varying from fine to particles passing a 3/8" screen, of which at least 12% shall pass a 50-mesh screen.
- F. Water: Clean, and not detrimental to concrete.
- G. Air Entrainment Admixture: ASTM C 260.

2.4 ACCESSORIES

- A. Curing Compound:
 - 1. Type 1 / E-Conc-1 (per paving plan): ASTM C 309, Type 1, Class A.
 - 2. Type 2 / E-Conc-2 (per paving plan): Scofield LITHOCHROME Colorwax. Color to match integral colorant.

- B. Joint Sealer: As specified on drawings.

2.5 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- C. Concrete Properties:
1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4000 or 4500 psi depending on pavement type as described in 3.13.
 2. Total Air Content: 5-7 percent, determined in accordance with ASTM C 173/C 173M.
 3. Maximum Slump: 3-4 inches.

2.6 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C 685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C 94/C 94M.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.2 SUBBASE

- A. See Section 32 1123 Aggregate Base Courses for construction of base course for work of this Section.
- B. Prepare subbase in accordance with State of Minnesota Highway standards and Section 32 1123.

3.3 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.
- C. Notify Engineer minimum 72 hours prior to commencement of concrete operations.

3.4 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

- A. Used within integral curb, see Section 03 3000 – Cast-in-Place Concrete.

3.6 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete in accordance with State of Minnesota Highway standards.
- C. Place concrete using the slip form technique.
- D. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
- E. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Apply surface retarder to all exposed surfaces in accordance with manufacturer's instructions.

3.7 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
 - 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
 - 2. Secure to resist movement by wet concrete.
- C. Provide scored joints:
 - 1. At 5 feet intervals or as shown on the drawings.
 - 2. Between sidewalks and curbs.
 - 3. Between curbs and pavement.
- D. Provide keyed joints as indicated.
- E. Saw cut contraction joints 3/16 inch (5 mm) wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.8 FINISHING

- A. Vehicular Paving:
 - 1. Type 1 / E-Conc-1 (per paving plan): Heavy broom texture perpendicular to pavement direction.
 - 2. Type 2 / E-Conc-2 (per paving plan): Finish concrete and apply Dayton Superior TOP CAST micro finish surface retarder or approved equivalent per manufacturer

recommendations. Surface retarder shall have aggregate exposure degree as reviewed and approved by the Architect during the mock ups.

- B. Sidewalk Paving: See Landscape Architectural.
- C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- D. Inclined Vehicular Ramps: Broomed perpendicular to slope.
- E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.9 JOINT SEALING

- A. See Section 32 1373 for joint sealer requirements.

3.10 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/8 inch in 10 ft.
- B. Maximum Variation From True Position: 1/8 inch.

3.11 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
 - 1. Owner will secure and pay for testing agency services.
 - 2. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 3. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 4. Inspection of reinforcement placement.
 - 5. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cu yd or less of each class of concrete placed.
 - 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - 2. Perform one slump test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

3.13 SCHEDULES

- A. Concrete Sidewalks, Curbs and Gutters: 4,000 psi 28 day concrete.
- B. Driveway, Integral Curb, or Equipment Pad Pavement: 4,500 psi 28 day concrete.

END OF SECTION

SECTION 32 1723
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Painting stall, crosswalks, ADA accessible aisle and ADA symbols on asphalt pavement surface.

1.2 RELATED SECTIONS

- A. Requirements of the General Conditions and Division 1 General Requirements of this Project Manual apply to work under this Section.
- B. Section 32 1216 – Asphalt Paving
- C. Section 32 1313 – Concrete Paving

1.3 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures.
- B. Certification by manufacturer that shows paint meets specifications. Submit with copy of MnDOT Qualified Products List.

1.4 REFERENCES

- A. Minnesota Department of Transportation Standard Specifications for Construction, 2005 Edition and Corresponding Supplements.

1.5 SITE CONDITIONS

- A. Weather Limitations: Do not apply when asphalt is wet or contains an excess of moisture.

1.6 PRODUCT HANDLING

- A. All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.7 EQUIPMENT

- A. All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable

of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted or removal of existing stripping patterns. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

PART 2 PRODUCTS

2.1 PAINT

- A. The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paint for parking areas and drives shall conform to AASHTO M 248, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.
- B. Paint shall conform to MnDOT Specification Section 2582 and qualified materials can be found on MnDOT's Qualified Products List on the Office of Traffic, Security and Operations website.

PART 3 EXECUTION

3.1 PAVEMENT MARKINGS

- A. Cleaning: Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.
- B. Do not apply traffic and lane marking paint until layout and placement has been verified with Owner and Engineer.
- C. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 1 coat at manufacturer's recommended rates.

3.2 APPLICATION

- A. All pavement markings and patterns shall be placed as shown on the plans.
- B. Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 5 degrees C (40 degrees F) and less than 35 degrees C (95 degrees F). Paint temperature shall be maintained within these same limits. New

asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified by manufacturer. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

- C. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 1 coat at manufacturer's recommended rates.
- D. Drying: The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.
- E. Alignment: Minimum linear pavement marking shall not be less than the specified width and shall not vary by more than 1/4". The width will not vary by a rate more than 1/4" per 10 feet. Alignment deviations from the design shall not vary by more than 1".
- F. Pavement marking material shall not be applied over a longitudinal joint.

END OF SECTION

SECTION 32 9200

TURF AND GRASSES

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. Sodding
2. Topsoil.

B. Related Sections:

1. Division 32 Section "Design Build Irrigation " for turf irrigation.
2. Division 32 Section "Exterior Plantings" for border edgings.
3. Division 31 Section "Grading" for topsoil and finish grading and "Erosion prevention" for erosion control

1.3 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth and meets the requirements of the University for topsoil in an irrigated area – sany loam.

- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: Soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, 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.
 - 1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.
- C. Qualification Data: For qualified landscape Installer.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. Material Test Reports: University will test topsoil to ensure proper PH Soil fertility and gradation. The contractor assumes risk of topsoil placement or amendment if topsoil is placed prior to test results. Topsoil pH shall be not less than 5.5 and no higher than 7.5. The owner's representative will coordinate testing with University Landcare.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: MNLA Certified Landscape Professional
 5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
 6. Pesticide Applicator: State licensed, commercial.
- B. Preinstallation Conference: Conduct conference at Project site prior to installation activities.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers[, lime,] and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
1. Spring Placement: Spring thaw to June 15th.
 2. Fall Placement: August 15 to November 1st.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established and Owner excepted but for not less than the following periods:
1. Sodded Turf: 30 days from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

- A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "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. Peat Sod: Sun and Partial Shade: Proportioned by weight as follows:
 - a. 50 percent Kentucky bluegrass (*Poa pratensis*).
 - b. 30 percent chewings red fescue (*Festuca rubra* variety).
 - c. 10 percent perennial ryegrass (*Lolium perenne*).
 - d. 10 percent redtop (*Agrostis alba*).

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
 - 2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
 - 3. Provide lime in form of ground dolomitic limestone or calcitic limestone.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) 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: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 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-inch (25-mm) 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: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.
- 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.

2.4 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde and potassium in the following composition:
 - 1. Composition: Nitrogen and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen and potassium in the following composition:
 - 1. Composition: Nitrogen and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.5 PLANTING SOILS

- 1. Per Section 312323 FILL: Section; Topsoil for irrigated areas shall be sandy loam to meet University of MN requirements.

2.6 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by the Landscape Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- B. Install 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 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 18 inches (457 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening.
 - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 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.
 - 3. Spread topsoil to a depth of 4 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.
 - a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If turf is 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 6 inches (150 mm). Apply soil amendments and fertilizers according to topsoil mix proportions and mix thoroughly into top 4 inches (100 mm) of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply fertilizer directly to surface soil before loosening.
 - 3. Remove stones larger than 1 inch (25 mm) 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 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
 - 1. Compact grade to minimum of 80% and Maximum of 85% density in Lawn areas
- E. Compact soil at edges of walks and drives to prevent settling and set finish grade 1" below adjacent pavement.
- F. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

- G. Before planting, obtain University of MN Landcare for grading inspection of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

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 after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.5 TURF MAINTENANCE

- A. Maintain and establish turf for a minimum of 30 days unless notified by Landcare. Maintain by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Keep turf uniformly moist to a depth of 4 inches (100 mm).
 - 1. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified 3" height without cutting more than 1/3 of grass height. Remove no more than 1/3 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 grass height. Remove any piles of clippings from lawn.

- D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.

3.6 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by University Landcare:
 - 1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities. Sod shall be substantially complete when sod is thoroughly knitted when a sod strip does not rise from the soil when grasped by the grass blades and lifted.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.7 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

END OF SECTION 32 9200

SECTION 32 9219

SEEDING INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Site and seedbed preparation for seeding areas
 2. Seed mixes, rates and installation
 3. Mulching and erosion control

1.2 DEFINITIONS

Approved Native Seeding Contractors:

1. Prairie Restorations
2. Minnesota Native Landscape
3. North American Prairies Company

MCIA: Minnesota Crop Improvement Association

PLS: Pure Live Seed is calculated as follows: Pounds of Bulk Seed x Germination Rate x Purity.
Minimum percent Purity is 80% and minimum percent Germination is 40% for forbs.

MnDOT Specifications: Minnesota Department of Transportation's 2005 Standard Specifications for Construction and the MnDOT Seeding Manual 2003, available at their website.

Mandatory seeding dates:

4. Spring period: March 15 – May 15.
5. Fall Seeding: August 20 – October 20.

Seed Drill –native grass drill such as Truax^R or Trillion^R

1.3 SUBMITTALS

Contractor qualifications (if not on approved installer list) – see section 1.4A of this specification.

Documentation that the mulch is certified by the Minnesota Crop Improvement Association (MICA).

1.4 QUALITY ASSURANCE

Pre-Qualified Native Seeding Contractor. The Contractor seeding the native prairie areas shall be selected from the list of approved native landscape installers. An installer NOT on the list who wishes to bid this project must document the following:

1. that the installer's business specializes in prairie or native landscape installations or restorations.
2. that the installer has at least three years of experience planting native prairies or savannahs or seeding installations of similar size to this project.
3. a list of at least three successfully completed installations proven by a good diversity of species and a low occurrence of non-natives. The installer shall provide a project owner contact with address and phone number.
4. that the personnel supervising and planting this project have documented experience successfully planting native landscapes.
5. that a qualified project supervisor shall be assigned to the project who is capable of being present full time during all installation and maintenance. Qualifications include a current herbicide and pesticide applicators license, a bachelor's degree in Natural

Resource Management or a related field, a minimum of five years experience in prairie/savannah restoration and maintenance supervision with experience or training in prairie and wetland management, entomology, pest control, soils, fertilizers, and plant identification.

6. that a labor force be assigned to the project that is thoroughly familiar and trained in the work.
7. that the installer has access to the equipment necessary for installing and maintaining a native landscape.

Seed and seedlings: Naturalized planting seed and seedling species shall have their genetic origin within 200 miles of the project site. Seed of Western Wisconsin origin is acceptable for use at this site.

All substitutions are subject to the approval of the Landscape Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

Seed shall be stored in a dark area at a temperature no higher than sixty degrees Fahrenheit and a relative humidity between 20 and 40 percent.

1.6 SITE CONDITIONS

Imported Topsoil shall be spread and site shall be fine graded by General Contractor or by his/her subcontractor. See Earthwork section of this specification.

Any site preparation by the seeding contractor shall be construed as acceptance of existing conditions.

1.7 SCHEDULING

General Contractor shall schedule site grading, seeding and related site preparation according to meet the following installation dates :

1. Spring period: March 15 – May 15.
2. Fall Seeding: August 20 – October 20.

PART 2 - PRODUCTS

2.1 HERBICIDE

Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

1. Acceptable products: Roundup by Monsanto or approved substitute.

2.2 COVER CROP

Spring and early summer seeding: field oats at 15-20 lbs per acre.

Dormant seeding (after October 1): spring or winter wheat at 15-20 lbs per acre.

2.3 SEED FOR NO MOW MIX

SEED MIX - Short Xeric Prairie Grass

<i>Blue grama (Bouteloua gracilis)</i>	15.0%
<i>Side-oats grama (Bouteloua curtipendula)</i>	30.0%
<i>June Grass (Koeleria cristata)</i>	1.0%
<i>Canada wild rye (Elymus canadensis)</i>	5.0%
<i>Little bluestem (Schizachyrium scoparium)</i>	44.0%
<i>Kalm's Brome (Bromus Kalmii)</i>	5.0%
<i>Broadcast seeding rate/acre</i>	18 pounds PLS
<i>Drill seeding rate/acre</i>	10 pounds PLS

2.4 MULCHES

Provide Minnesota Crop Improvement Association (MCIA) certified "weed free" mulch. Each bale must be tagged and tags must be shown to landscape architect prior to spreading.

In lieu of MCIA certified weed free mulch, use MnDOT Type 7 A or B mulch.

2.5 EROSION CONTROL BLANKET

MnDOT Specification 3882, Category 3, Straw 2S

PART 3 - EXECUTION

3.1 SITE PREPARATION

Schedule site preparation to allow seeding to occur within the preferred spring and fall seeding periods (see section 1.2E of this specification).

Subgrade preparation:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Grind out and remove any tree stump over 2" in diameter. Cut all lesser diameter trees and shrubs close to grade and apply Round-Up[®] at 45% strength to freshly cut stump.
3. Ensure that a minimum of 4" of topsoil has been applied over areas to be seeded, and that proper preparation of the subgrade has been completed. See the soil decompaction notes on landscape plan bid documents.

Eliminate unwanted vegetation from areas to be seeded

4. ALLOW NEWLY GRADED TOPSOIL TO SIT FOR ONE MONTH TO ALLOW SETTLING AND TO ENCOURAGE WEED SEED GERMINATION. To prevent erosion during this waiting period, sow areas to be seeded with a cover crop of ANNUAL small grain cover crop such as oats or rye. At the end of the one month period, mow to a height of 4" all growth in areas to be seeded.
5. Treat all new growth, including cover crop with a broad spectrum herbicide such as Round-Up[®] at an application rate of 5 pints/acre.
6. Allow area to green up for a minimum of seven, preferred maximum of fourteen days. Make a second application of Round-Up[®] on all areas that show regrowth.

After another seven to ten days, till the site with appropriate tillage equipment (disk or chisel plow) to a depth of 4" (10 cm).

Harrow or rake the area to be seeded in order to CREATE A FIRM SMOOTH SEED BED. This operation shall break up root systems and soil clods so that the average clump is less than 2" inch diameter. Remove all rocks greater than 4" and all debris. (If one walks across seed bed areas and leaves footprints greater than ½" in depth, the seed bed needs to be further compacted.)

Using a rolling-type packer, pack any areas of tilled, loose, or regarded soil within the zone to be seeded.

3.2 SEEDING

Seed during defined windows of time in spring and fall.

Mix native grass seed with cover crop.

1. Spring and Fall seeding: field oats at 30 lbs per acre.

Sow native grass seed using a native grass drill, such as a Truax or Trillion. In areas too cramped for equipment or on very small sites where it is not practical to use large equipment, seed can be broadcast by hand or with a mechanical spreader. Seed application rates vary for each mix – see Products, Section 2.

Follow native grass seeding with harrowing or raking to incorporate seed into seedbed

Following native grass seed introduction, broadcast native wildflower or forb seeds. Broadcast the forb seed at the application rates shown in mix descriptions, Section 2 Products . Cultipack the seeded areas with a heavy roller to press the small wildflower seeds into the seedbed and further firm the site.

3.3 MULCHING/EROSION CONTROL BLANKET

Submit MCIA "weed free" mulch certification to landscape architect prior to delivering mulch to the site.

All seeding work shall be mulched with clean oat, wheat or prairie straw (MnDOT Type 7A or &B). Mulch rate is 2 tons per acre for oat or wheat straw and 1.5 tons/acre for native prairie straw. Native prairie straw is preferred.

Straw mulch shall be disk-anchored in place immediately after being spread to prevent wind from blowing it away or secure it in place by hydraulically-applied liquid tackifier.

All areas with slopes greater than 1 in 10 (10% slopes or greater) require erosion control blanket in lieu of mulching. Mulching is not required under erosion control blanket.

3.4 GUARANTEE

Germination and grown of 85% of seed shall be verified by landscape architect, University of Minnesota Landcare, and contractor 1 year after seed installation.

END OF SECTION

SECTION 32 9300

EXTERIOR PLANTINGS

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. Plants.
2. Planting soils.
3. Tree stabilization.
4. Tree Spading
5. Landscape edgings.
6. Landscape Mulch

B. Related Sections:

1. Division 31 Section "Site Clearing" for protection of existing trees and plantings, , and site clearing.
2. Division 31 Section "Grading" for excavation, filling, and rough grading and for subsurface preparation, aggregate drainage and drainage backfill materials.
3. Division 32 Section "Turf and Grasses" for turf lawn and erosion-control materials.
4. Division 31 Section "Fill" for topsoil and placement of soils

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when

removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size, grade and quality of plant required. No substitutions of specified plant material shall be made without written permission for the owner's representative.

- E. Finish Grade: Elevation of finished surface of planting soil.
- F. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- G. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- I. Planting Area: Areas to be planted.
- J. Planting Soil: Manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- K. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- L. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- M. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
 3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Samples for Verification: For each of the following:
1. Organic and Compost Mulches: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
 2. Mineral Mulch: 2 lbs. of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
 3. Weed Control Barrier: 12 by 12 inches.
 4. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
- C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
1. Manufacturer's certified analysis of standard products.
 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- E. Material Test Reports: For imported or manufactured topsoil.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time English speaking supervisor on Project site when work is in progress.
 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
 - b. Certified Landscape Technician - Interior, designated CLT-Interior.
 - c. Certified Ornamental Landscape Professional, designated COLP.
 5. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the Minnesota Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- D. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- E. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.
- F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

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- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- D. Handle planting stock by root ball only.
- E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 2. Do not remove container-grown stock from containers before time of planting.
 3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
1. Notify Construction Manager no fewer than two days in advance of proposed interruption of each service or utility.
- C. 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: Last frost date to June 15th.
 2. Fall Planting: August 15 - November 15th.

3. Evergreen plantings: August 15 – October 1

- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- E. Coordination with Seed/sod Areas: Plant trees, shrubs, and other plants after finish grades are established and before planting seeded/sod areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas, protect seed/turf areas, and promptly repair damage caused by planting operations.

1.8 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of tree stabilization, edgings or tree grates.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - e. Trees that are planted too deep.
 - 2. Warranty Periods from Date of Substantial Completion:
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Perennials and Other Plants: 12 months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: The contractor is responsible for all maintenance until the owner's representative accepts responsibility. Provide maintenance by skilled employees of landscape installer. Maintain as required in Part 3. Begin maintenance immediately after each plant is installed and continue until installation of all planting is complete, inspection has been made and planting is accepted exclusive of guarantee.

PRODUCTS

1.10 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.
- E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Tree Spading: Submit pictures of trees to be transplanted per Landscape Architects approval.
- G. To meet the university's commitment to provide a selection of plant material on campus for academic purposes, no substitutions of specified plant material sizes, grades, species,

qualities or forms shall be made without the written permission from the owner's representative.

1.11 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
 - 2. Provide lime in form of ground dolomitic limestone.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 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: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

1.12 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 3/4-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: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. 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.

1.13 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde and potassium in the following composition:
 - 1. Composition: Nitrogen and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen and potassium in the following composition:
 - 1. Composition: Nitrogen and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

1.14 PLANTING SOILS

- A. Planting soil: Topsoil as specified in Fill Section 31.

1.15 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type Trees and shrubs: Shredded hardwood.
 - a. Depth: 4" settled
 - 2. Type perennials: Double Shredded Hardwood
 - 3. Size Range: 3 inches maximum, 1/2 inch minimum.

4. Color: Natural.
- B. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:
1. Type: A : Dresser Trap Rock
Size Range: 9"-12" diameter.
Color: Gray range
 2. Type B – Dresser Trap Rock
 - a. Size Range 15"- 18" Diameter
 - b. Color: Gray range
 3. Type C: Dresser Trap Rock
 - a. Size Range 3/ 4 " Diameter
 - b. Color: Gray range

1.16 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids. **Weed Control Fabric prohibited in planting areas.**

1.17 LANDSCAPE EDGINGS

- A. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
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. Ryerson Steel, J.T. & Son, Inc.
 - b. Sure-Loc Edging Corporation.
 - c. Approved Equal
 2. Edging Size: 3/16 inch wide by 4 inches deep.
 3. Stakes: Tapered steel, a minimum of 15 inches long.
 4. Accessories: Standard tapered ends, corners, and splicers.
 5. Finish: Standard paint.
 6. Paint Color: Black.

1.18 LIGHTWEIGHT ROOFTOP SOIL

- A. Acceptable Manufacturer:
1. Plaisted Companies
 2. 11555 205th Ave. NW, Elk River, Mn 55330
 3. 763-441-1100, Fax: 763-441-7782

- B. Product:
 - 1. 'Intensive Garden Roof'
 - 2. Blend growing media consists of 50% stalite (3/8" Rotary Kiln Expanded Slate Aggregate), 10% Stalite fines, 25% USGA Root Zone Sand, 15% organic compost.
 - 3. Design Load not to exceed 80 Lbs per cubic foot saturated
- C. Substitutions: Any soil changes

1.19 MISCELLANEOUS PRODUCTS

Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

- A. Burlap: Non-synthetic, biodegradable.
- B. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

2.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install 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.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transport.

2.3 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 18 inches, Remove stones larger than 1½ inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening.
 - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 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
 - c. Spread topsoil to a depth of 18 inches but not less than required to meet finish grades after natural settlement. Blend the first 2 inches of topsoil into the rough sub-grade material by rototilling.
 - 3. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Perform Finish grading and planting when soil is dry. Compaction shall be a minimum of 80 percent and maximum of 85 percent of maximum density in all lawn and planting areas.
- C. Compaction Testing: The University will retain an independent testing agency to conduct compaction tests. The University shall pay for the original tests. Areas that do not meet compaction requirements shall be compacted and tested again until specifications are met. The contractor shall pay the cost for re-compaction as well as revisit the areas.

- D. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

2.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Percolation Test: The university will retain an independent testing agency to conduct percolation test to verify water drains from soil. Tests are as follows: Drill a 4-inch hole to a depth of 24" ; pour 6 inches of gravel into the hole and cover with water. Allow water to drain for one hour and refill the entire hole with water. To pass the test the water must drain out at a rate of 1 inch per hour or greater. If hardpan zones are encountered while drilling a second test using a 4" diameter tube shall be conducted to verify vertical drainage.

B.

Upon direction, contractor shall install a drain stack at the bottom of the planting pit. Auger a 4" minimum diameter hole to a depth of 42" from the bottom of the plant pit and fill it with $\frac{3}{4}$ " gravel. Cover the gravel with filter fabric and install plant material as directed.

- C. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected overnight.
8. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.

- D. Subsoil and topsoil removed from excavations may not be used as planting soil.

- E. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

- F. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- G. Fill excavations with water and allow it to percolate away before positioning trees and shrubs.

2.5 TREES AND SHRUBS

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements. Reject any tree with more than 4" of soil covering first true root.
- B. Plant trees and shrubs with the root flare of the plant at grade level. The radius of the tree pit shall be a minimum of 12 inches larger than the radius of the tree ball. After placing in planting pit, remove the material around the ball, as well as the burlap, including the burlap, twine and wire from the upper one-third of the ball..
- C. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- D. Set balled and burlapped stock plumb and in center of planting pit or trench with first higher order root flare level with adjacent finish grades. **University will not accept trees that are planted to deep.**
 - 1. Use planting soil for backfill.
 - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.

2.6 TREE SPADE

- A. Contractor to call Gopher One prior to digging
- B. Perform a soils test on the existing tree to be spade and submit to Landscape Architect for review.

- C. Spade size shall be of a size to accommodate the rootball sufficient to sustain the tree after planting. Follow Nurseryman standards
- D. Roughen up the newly dug hoe to remove glazing of the pit prior to planting.
- E. Perform a Plant Pit text to insure adequate drainage. Install drainage if necessary per the detail.
- F. Plant 1" to 2" above the surrounding hole to allow for settlement 7. Stake the tree as required to provide secure anchoring from blow-over or uprooting. Remove after the first year.
- G. Immediately water and saturate the soil ball and surrounding soil.
- H. Install Mulch per the detail and 10 – 12" beyond the original rootball
- I. Set container-grown stock plumb and in center of planting pit or trench with first higher order root flare 1 inch above adjacent finish grades.
 - 1. Use planting soil for backfill.
 - 2. Carefully remove root ball from container without damaging root ball or plant.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- J. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

2.7 TREES AND SHRUBS

- A. Prune, thin, and shape trees and shrubs according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- B. Do not apply pruning paint to wounds.

2.8 TREE STABILIZATION

- A. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.

1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
 - a. Install stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation. Saw stakes off at horizontal stake.
 - b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Pre-drill holes if necessary to prevent splitting wood.
 - c. Install second set of stakes on other side of root trunk for larger trees as indicated.
2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

2.9 PLANT PLANTING

- A. Set out and space plants other than trees and shrubs as indicated in even rows with triangular spacing or as shown on plans.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

2.10 PLANTING AREA MULCHING

- A. Install weed-control barriers in all areas to receive mineral mulch only and before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins. Do not place Fabric in areas to be planted.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 1. Trees in Turf Areas: Apply organic mulch ring of 4-inch average thickness, with 24-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.

2. Organic Mulch in Planting Areas: Shrubs: Apply 4-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Herbaceous plants: Apply 3-inch average thickness of organic mulch without weed barrier over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

2.11 EDGING INSTALLATION

- A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches apart, driven below top elevation of edging. All lines to be true, straight and smooth and all curves to have smooth continuous arcs.

2.12 PLANT MAINTENANCE

- A. The contractor shall be responsible for all maintenance until the owner's representative accepts responsibility. Maintenance shall begin immediately after each plant is planted and shall continue until installation of all planting is complete, inspection has been made and planting is accepted exclusive of the guarantee.
- B. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- C. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- D. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
- E. The maintenance of planted materials shall include watering, straightening plants, protecting plant areas from erosion, maintaining erosion material, supplementing mulch, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, weeding, removing and replacing unhealthy plants. straightening, resetting plants to proper grade or upright positions and other necessary operations.
- F. A plant shall be considered unhealthy or dead when the main leader had died back, or 25 percent of the crown is dead, or it has been determined that a plant's health is being compromised due to disease or pests. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit in accordance with the warranty paragraph. Maintenance shall include watering, weeding, mowing, mulching, pruning.

CLEANUP AND PROTECTION

- G. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- H. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- I. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

2.13 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

PROJECT WALK THROUGH

- A. The contractor shall complete the work and submit a written request for a walk through.
- B. The Landscape Architect will walk through the project and develop a punchlist. University LandCare may also attend.
- C. The contractor will complete the punchlist, care for plants as necessary and request a final walkthrough.
- D. When the final walk through is accepted a Certificate of Substantial Completion will be issued. The University Landcare will assume care of lawns and plantings .

END OF SECTION 32 9300