

SPECIFICATIONS

Energy Sciences Building Issued for Proposal Building No. 241

**Contract No. 9H-30421
Project No. 002182-98502-ESB**

Volume 1: Divisions 1 – 14

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HDR

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SECTION 1A0

GENERAL CONDITIONS

RELATED DOCUMENTS

These General Conditions apply to all Divisions of this specification.

INTENT OF DRAWINGS AND SPECIFICATIONS

The Contractor shall furnish all labor, material, tools, equipment, plant and services necessary to complete the work shown on the drawings, in strict accordance with the various divisions of these specifications.

The drawings and specifications are intended to include everything obviously requisite and necessary to the proper and entire completion of the work whether or not each item is specifically mentioned. In the event of inconsistency between the drawings and specifications, the specifications shall govern.

Wherever it is required in these specifications or on the drawings that the Contractor provide apparatus or equipment, it shall be understood that the Contractor shall furnish, install and connect such apparatus or equipment in a complete manner to insure satisfactory operation, except when otherwise definitely specified. All material and equipment shall be new unless otherwise specified.

DEFINITIONS

Wherever the word "Laboratory" appears on the drawings or specifications, it shall be construed to mean the "Argonne National Laboratory".

Wherever the word "Contractor" appears on the drawings or specifications, it shall be construed to mean the entity who is responsible to the Laboratory for the successful execution of the project construction and other requirements of the contract documents.

When the terms "approved", "satisfactory", "equal", "approved equal", "proper", or "as directed" are used, they shall be interpreted as meaning "approved", etc., by the Laboratory.

STANDARDS, CODES AND FEDERAL SPECIFICATIONS

The standards, codes, Federal Specifications and other recommendations and publications referred to in these specifications shall be of the latest issue (including all amendments) in effect on the date of the specifications.

Where requirements are in excess of the above standards, codes and Federal Specifications, the Contractor shall be bound by the information indicated in the specifications and/or on the drawings.

SITE INSPECTION

It is expected that the Contractor has visited the site and has become thoroughly acquainted with all conditions relative to the site, work location and all other matters which might affect the work to be performed.

VERIFICATION OF DIMENSIONS

Wherever existing obstructions or dimensional inaccuracies capable of verification by the Contractor in the field, or wherever minor variations of indicated arrangements or dimensions of equipment, interfere with the installation as shown on the drawings, the Contractor shall make such necessary alterations as are approved by the Laboratory and such alterations shall not constitute a basis for extra charge.

SUBSTITUTION OF EQUIPMENT AND MATERIALS

The naming of manufacturers in the specifications or on the drawings shall not be construed as an intention to eliminate the products of other manufacturers having approved equivalent products. The substitution of material other than that named in the specifications or on the drawings, may be made only after the approval of the Laboratory has been granted in writing. Any request for substitution must be accompanied and substantiated by written technical and operational data.

Any necessary modification of equipment, building, piping, ductwork, electrical or any other work resulting from the use of equipment or materials other than that first named in the specifications, and any construction work related to such modification shall be the responsibility of the Contractor notwithstanding approval of same by the Laboratory, shall be without cost to the Laboratory and the Contractor shall not be entitled to any additional payment or extension of time by reason thereof. The Contractor shall submit with the request for use of equipment or materials, other than that first named in the specifications, the necessary modifications resulting from such use, and obtain Laboratory approval before proceeding with the procurement. The Laboratory's approval will not relieve the Contractor from sole responsibility for proper installation and functioning of such equipment or materials, nor will the necessary review by the Laboratory of the data submitted be considered as a basis for any additional payment or extension of time for performance of the contract work.

BREAKDOWN OF CONTRACT PRICE

Whenever progress payments are to be made, or if otherwise requested by the Laboratory, the Contractor shall, before starting work, submit a breakdown estimate of the amount of the contract. This estimate breakdown shall itemize all work items including the number of units, unit prices and total estimated cost for each work item. This estimate, which will include all overhead and profit spread over the work item costs proportionately, will constitute the basis for partial payments (if any) to the Contractor.

CONSTRUCTION SCHEDULE

The Contractor shall, before starting work, submit a construction schedule in a form satisfactory to the Laboratory (Reference Section 01 31 00).

APPROVAL OF SUBCONTRACTORS

The Contractor shall, with its proposal, submit for approval by the Laboratory a list of the proposed Subcontractors who will be performing work at the site. Included on this list shall be the type of work each Subcontractor will perform (Reference Section 00 43 00).

EQUIPMENT PURCHASE ORDERS

The Contractor shall immediately place purchase orders for all materials and equipment necessary to complete all work on schedule and shall be prepared to submit one (1) copy of purchase orders to the Laboratory when requested.

DIGGING PERMITS

Existing underground utilities shall be exposed by hand digging done during the regular Laboratory working hours, Monday through Friday, in accordance with provisions contained in the "Digging Permit". The "Digging Permit" is obtained by the Laboratory representative and approval given to the Contractor. After the existing underground utilities stated in the "Digging Permit" have been exposed by hand digging, machines may be used for the remaining excavation in accordance with the provisions in the "Digging Permit".

SHUTDOWN OF BUILDING FACILITIES

The installation shall be scheduled by the Contractor so as to minimize shutdown of Laboratory facilities. All necessary shutdowns must be arranged with the Laboratory at least forty-eight (48) hours in advance of the required shutdown time.

USE OF EXISTING UTILITIES

The Laboratory will make existing utilities such as water, steam and electricity available to the Contractor without cost where such utilities are conveniently located with respect to the work site. The Contractor must provide all materials, labor and equipment necessary for extending existing utilities to the point of use. The method of connection into existing utilities must be approved by the Laboratory and these connections to utilities shall be under the immediate supervision of the authorized Laboratory representative. The Contractor will be held responsible for the proper installation, operation and maintenance of temporary utilities and must adhere to all uniform codes governing such installations. Upon completion of the work, the Contractor shall remove all temporary utility lines and restore existing utilities to the original condition as directed by the Laboratory.

SUPERVISION BY CONTRACTOR

The Contract stipulates that the Contractor shall, at all times during the progress of the work, provide a competent Project Manager and Superintendent. The Project Manager and/or Superintendent shall be vested with the necessary authority to direct and schedule the work of the Subcontractors, who may be engaged in the work and represent his/her firm in matters that may be referred to him/her by the authorized Laboratory representative.

COORDINATION

References which are made to the Contractor throughout these specifications under the various divisions refer to both the Contractor and/or Subcontractors who may be performing the particular work items. The necessary coordination between the work to be performed by the Contractor and that of the Subcontractors shall be the responsibility of the Contractor. Inclusion of all work items including materials, equipment and installation shall be considered as contained in the proposal to be submitted. The responsibility for determinations as to which Subcontractor shall purchase and which Subcontractor shall install shall be vested completely in the Contractor, who shall also establish the work schedules for the various trades that may be required in the execution of the work.

CONTRACTOR'S WORK AREA

The work area, material and equipment storage area, location of construction office and similar installation areas will be established on the drawings or by the authorized Laboratory representative. The Contractor shall be limited in his/her access to these areas to the most direct route from public and Laboratory roads, shall be responsible for restricting the movements of his/her employees, watchmen, subcontractors and all associated personnel to the construction limits, and shall have no privilege of access beyond the established limits except as permitted for the installation of utilities and services.

Should the Contractor elect instead to establish a more permanent office for its own use, arrangements may be made with the Laboratory representative for a location, all related expense to be assumed by the Contractor.

CUTTING AND PATCHING

In the event that during the cutting of concrete or masonry, including floors, walls, or roofs, and whether or not shown on the drawings, any reinforcing rods, bars, etc., are cut, or should any utility be damaged, the Contractor and his Subcontractors of any tier shall immediately stop all such cutting until permission to resume cutting is obtained from the authorized Laboratory representative and shall take such precautionary measures as directed thereby. The Contractor and his Subcontractors of any tier are responsible for the repair of all damage resulting from improperly proceeding with the work, at no expense to the Laboratory. In addition, the Contractor and his Subcontractors of any tier are required to prevent free silica dust exposures in excess of the American Conference of Governmental Industrial Hygienist Threshold Limit value. Refer to Section 01 49 90.

SHOP DRAWINGS

As used in this clause "shop drawings" means:

Supplemental drawings prepared for a specific installation under this contract showing accurate dimensions and all details necessary to fully define the work and assure proper execution and completion of the work.

Manufacturer's drawings, instructions, specifications, catalog data such as performance charts and curves, wiring diagrams and data, showing all information necessary to describe the physical and/or performance characteristics of equipment and products to be furnished by the Contractor.

Shop drawings shall be submitted by the Contractor to the Laboratory for approval where (1) shop drawings are called for in the contract documents; (2) the Contractor desires to perform any portion of the work in a manner differing from that called for in the contract documents; (3) the Contractor desires to substitute equipment or products for such items called for in the contract documents whether or not such substitutions require rearrangement of any portion of the work.

Reference Section 01 33 00 for general submittal requirements and Section 01 04 00 for coordination shop drawing requirements.

The Contractor shall furnish the originals of all approved shop drawings prepared only for this contract.

The delivery or installation of any of the items for which shop drawings are required shall not be started until such drawings have been approved. Items delivered or installed, without such approval shall be at the risk of the Contractor.

The Laboratory's approval of shop drawings shall not relieve the Contractor of responsibility for defects in design or other errors or omissions in such drawings nor from compliance with all requirements of this contract.

RECORD DRAWINGS

Deviations from the contract drawings may be made only after permission has been granted by the Laboratory in writing. Concurrently with the progress of construction, a set of record drawings, consisting of a marked set of the contract drawings shall be maintained by the Contractor. They shall denote and dimension accurately all changes in elevation, location, size of material or any other approved deviations from the contract drawings, and at the completion of the work, shall be returned to the Laboratory. (Reference Section 01 72 00 for detailed requirements.)

EQUIPMENT NAME PLATES

All manufacturers' nameplates on equipment items are to be kept visible and are not to be obscured by other equipment or piping nor are they to be covered by any paint or insulating material.

REPAIRS

Any damage to existing facilities such as roads, lawns, buildings, utilities, equipment, fixtures, etc., during the course of work by the Contractor and his Subcontractors of any tier or as the result of work performed by the Contractor and his Subcontractors of any tier must be repaired to the satisfaction of the Laboratory without additional cost to the Laboratory.

TEST REPORTS

Systems Testing: Whenever it is hereinafter specified that a particular mechanical, electrical, or other system be tested, three (3) copies of all test reports shall be furnished to the Laboratory.

Materials Testing: Whenever it is hereinafter specified that a particular material (except concrete) be tested, three (3) copies of all test reports shall be furnished to the Laboratory. Tests shall be performed by a reputable testing organization at no cost to the Laboratory. Whenever it is hereinafter specified that concrete samples be taken for testing, such tests will be performed by the Laboratory at no cost to the Contractor.

SAMPLES

Whenever it is required herein that sample of materials are to be furnished by the Contractor for approval, such samples shall be furnished in triplicate and shall be identified as to nature or make, proposed usage, location, size, color and other pertinent information. Upon approval, one (1) sample will be returned, properly marked "Approved", for reference of the Contractor. Each sample shall bear a tag or label giving the name of the Contractor, supplier or manufacturer, the trade name of material and any other information necessary to properly identify the material. Sufficient blank space shall be left on each identifying tag for the Laboratory's stamp of approval.

BARRICADES AND FLARES

The Contractor shall provide all barricades as required for open trenches, temporary backfilled areas, etc. and shall provide and maintain adequate lights and flares for the night marking of barricade locations and any other hazardous locations.

CLEANING AND PROTECTION OF PREMISES

The Contractor shall exercise care to prevent dust, debris, mud and water from being spread to areas other than the construction area. Periodically and upon completion of construction, the work area shall be cleaned to a condition corresponding to the general cleanliness of the building and/or surrounding area as determined by the authorized Laboratory representative. Such cleaning shall be conducted in a manner so as to prevent employee exposures to hazardous chemicals (e.g. dust, mists, fumes, vapors, and gases) in excess of established allowable exposure limits. The Contractor shall clean all apparatus thoroughly before placing same in operation and again after each operation. Finished surfaces, if damaged, shall be restored to the satisfaction of the authorized Laboratory representative. The Contractor shall remove all concrete, mortar, plaster and insulation droppings and all paint spots, and remove same regularly from premises. The Contractor shall place all flammable materials either in the original container, or in metal containers with metal covers that are UL listed and FM approved for the intended use, and remove same regularly from premises. Exterior openings into buildings occupied by the Laboratory, whether existing or to be made by the Contractor, shall be kept closed when not in use or completed to maintain the temperature and cleanliness of the occupied space.

When working on the roof, the contractor shall be responsible to protect the existing roof and areas below the roof during construction. Prior to start of any construction work, the contractor shall inspect the site with the Laboratory representative to examine existing condition of the roof

and related areas. Methods of protection to be used during construction for roof (e.g. walkways, work areas, storage areas, temporary roof openings, etc.) shall be agreed upon. All the openings made to the existing roof shall be sealed (water tight) before the end of each working day. Regular or overtime work required to protect Laboratory property from potential damage which may be caused as a result of contractor's work prior to acceptance shall be at his/her expense. Also, contractor shall schedule his/her work such that the permanent installation work related to these openings proceeds as expeditiously as possible.

DISPOSAL OF EXCESS MATERIALS, EQUIPMENT AND DEBRIS

The Contractor shall remove accumulated construction debris as the work progresses and upon completion shall remove from the property of the Laboratory all remaining construction debris, excess material, equipment, tools and temporary construction. Clean scrap metals may be delivered, at the Contractor's option and subject to approval by the Laboratory, to a scrap metal depository located at a Laboratory designated area. Unless specified elsewhere, the authorized Laboratory representative will decide and instruct the Contractor as to whether removed materials and equipment shall be considered salvageable or worthless. Salvageable materials and/or equipment, which are to remain the property of the Laboratory, and, unless otherwise specified, shall be transported by the Contractor to a location within the boundaries of the Laboratory. This location will be designated by the authorized Laboratory representative who will also arrange for the final disposition. Excess excavated materials, worthless materials, equipment, and/or construction debris removed from the construction site shall be disposed of off site by the Contractor. Disposal shall be in accordance with all Federal, State and Local rules and regulations. A Health Physics survey of ALL construction debris and items is required and shall be performed by the Laboratory prior to the Contractors removal of such items from the work site. The Contractor is required to report to the Laboratory on a monthly basis the number of tons or fractions thereof of any waste materials which are removed from the site.

All Contractor generated debris and rubbish will be disposed of in trash dumpsters provided by the Contractor that are to be located within the Construction limits of, or adjacent to, the work area.

An area will be designated by the Laboratory for cleaning out of concrete trucks and equipment. The Contractor will be responsible for clean-up and transportation of the hardened concrete from the clean-out area. The Contractor shall remove and transport the hardened concrete off-site and the concrete is to be disposed of in accordance with all Local, State, and Federal codes.

All surplus soil generated during excavation and backfill is to be relocated to Area 800 at ANL as directed by the Laboratory. All surplus soil will be separated between topsoil and clay in Area 800 as directed by the Laboratory.

All hazardous waste generated on site will be disposed of by the Laboratory. Hazardous waste will be collected and held for Laboratory pick-up in an approved container, stored in a designated area, in an approved manner. **Hazardous material shall only be brought to the site in sufficient quantities to accomplish the task for which its use is intended. Under no circumstances will bulk quantities be brought to or stored on the job-site by the Contractor, or any of the lower tier Subcontractors.**

SPECIAL TOOLS

Where special tools are required for operation or adjustment of any equipment or special items such as control components, instruments, registers, dampers, etc., the Contractor shall furnish same including all the necessary duplicates required for normal use or as requested by the Laboratory.

TELEPHONE FACILITIES

The Contractor shall provide for its own telephone facilities for all construction personnel. Phone lines can be extended to the Contractor's trailer at the Contractor's cost by arrangement with the Laboratory.

SIGNS AND ADVERTISEMENTS

Signs or advertisements will not be allowed on the building enclosure or on the site except as approved in writing by the Laboratory.

SAFETY AND FIRE PROTECTION

Pursuant to the clause entitled "Safety and Health" of Appendix A, Terms and Conditions of the Contract, the Contractor shall comply with the following:

Regulations, Codes, and Standards

The following list of regulations, codes, and standards shall be considered minimum requirements:

Manual of Accident Prevention in Construction. The Associated General Contractors of America, Inc.

National Fire Codes, including the National Electric Code NFPA 70 and the Standard for Electrical Requirements for Employee Workplaces NFPA 70E, National Fire Protection Association (NFPA).

The BOCA National Building Code; Building Officials and Code Administrators International, Inc.

The International Building Code, 2000 (IBC)

Motor Carrier Safety Regulations, U. S. Department of Transportation.

Underwriters Laboratories, Inc. lists of inspected appliances, equipment and materials.

Safety and Health Regulations for Construction (29 CFR 1926) and Occupational Safety and Health Standards (29 CFR 1910) of the Occupational Safety and Health Administration, U. S. Department of Labor.

National Electrical Safety Code (ANSI C2), the Institute of Electrical and Electronics Engineers, Inc.

Reports

The reports required of the Contractor shall include, but shall not be limited to, the following:

"Individual Accident/Incident Report" on Form "DOE F 5484.X" for all occupational injuries/illnesses requiring treatment more extensive than first aid or to report fire or other property damage.

All contractors and their subcontractors shall report the hours worked at the Laboratory on a monthly form as provided by the Procurement Department Manager of Construction Contracts.

Safety Program

The Contractor shall refer to General Conditions and Specification Section 01 49 90 for general safety requirements associated with the Work.

END OF SECTION

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1AO-10

Issued for Construction - 6/30/11

SECTION 01 00 10
SPECIAL CONDITIONS

RELATED DOCUMENTS

These Special Conditions apply to all Divisions of these specifications.

LOCATION OF WORK

This project site is located at:

Argonne National Laboratory
9700 South Cass Avenue
Argonne, Ill 60439

SCOPE OF WORK

Reference the attached: General Construction – Scope of Work Document.

QUALITY ASSURANCE

A complete set of the contract drawings and specifications shall be available at the job site at all times when workmen are present. All work may be stopped if these documents are not readily available to all construction personnel.

The drawings and specifications provide, under the appropriate specifications section, such references to codes and standards as are necessary to ensure adequate Quality Assurance for that portion of the project.

The Laboratory reserves the right to designate mandatory hold points for inspection and testing. The Laboratory also will perform inspection of work in progress as it deems appropriate to ensure compliance with the specifications, drawings, codes and standards. The Laboratory may employ an independent testing agency to perform soils, concrete and materials testing prepared by the agency. The Laboratory will provide the Contractor with copies of pertinent inspection and test data on a timely basis.

The following inspection hold points for inspection are required at the following times:

- Prior to backfill over utilities;
- After placement of each lift of backfill and pavement base course;
- Prior to placement of concrete;
- After cable termination;
- Prior to pressure testing of piping systems; and
- Flood Testing of Roof.

The Department of Energy and Argonne National Laboratory are very concerned that substandard/suspect/counterfeit materials and parts are not being incorporated into the Work. As part of its implementation of its QA/QC program, the successful offeror shall ensure that no

suspect/counterfeit materials or parts are installed in the Work.

Rigorously observe all the pertinent requirements of OSHA - Occupational Safety and Health Administration Regulations and EPA-Environmental Protection Agency Regulations. The Laboratory will closely monitor compliance with all OSHA and EPA Standards and may stop work at any time when violations are observed. Such stoppage shall not relieve the contractor from fulfilling the completion date, nor shall it be a basis for any claims or additional costs.

Quality of Equipment: Use specified equipment and supplies only. Any deviations require written Laboratory approval.

MSDS: Contractor is responsible for keeping Material Safety Data Sheets available at the job site. MSDS are required for all chemicals. (Examples: Paints, degreasers, adhesive materials used for mechanical insulation.)

Welding: All welding shall be performed in compliance with the current edition of the ASME Boiler and Pressure Vessel Code.

DEFINITIONS

Contract Specialist: Member of the Procurement Division with administrative responsibility for this work. All correspondence and other business contacts will clear through that office. Any addition, deletion or change to the work which may result in an extra charge or a credit to the Laboratory must be approved by the Contract Specialist prior to proceeding with the work.

Project Manager: Member of the Laboratory Office of Project Management (OPM) in whom primary responsibility for engineering control of the project has been vested.

Construction Manager: Member of the Laboratory staff in whom primary responsibility for day to day control of the construction site and construction progress has been vested.

Installer: The person or entity engaged by the Contractor or Subcontractor for the performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a general requirement that Installers be recognized experts in the work they are engaged to perform.

Indicated: The term "Indicated" is a cross reference to details, notes, or schedules on the drawings, other paragraphs or schedules in the specifications, and similar means of recording requirements in the contract documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for the purpose of helping the reader accomplish the cross reference, and no limitation of location is intended except as specifically noted.

Active Area: In the context of this specification is defined to be any area with existing or potential radiation hazard.

Controlled Area: Is defined to be any area, access to which is controlled for reasons of radiation safety or other designated hazard. Any particular location of the entire Laboratory site may be designated as a "Controlled Area." The Laboratory is responsible for the determination of designated "Controlled Areas."

Protected Area: In the context of this specification, is defined to be all the area within the boundary fence of Argonne National Laboratory, under administrative control for security reasons, and requiring gate passes for admittance.

Furnish: Except to the extent further defined, the term "furnish" is used to mean "...supply and deliver to the project site, ready for unpacking, assembly and installation...."

Provide: Except to the extent further defined, the term "provide" means to furnish and install, complete and ready for the intended use.

Guarantee and Warranty: One Year. For details of guarantee refer to the Contract Documents, clause 36 "Warranty of Construction, Appendix A, Argonne Terms and Conditions For Fixed Price Construction Contracts, dated August 13, 2010".

Radiation Safety: The Contractor shall comply with LABORATORY radiation safety requirements and procedures as directed by the Laboratory for all work.

Full Body Harnesses and Lanyard: Contractor must use full body harness with lanyard limiting fall to 6 feet, in lieu of standard safety belts. Lanyard must be attached to secured anchor point.

SECURITY REQUIREMENTS

Only persons meeting the security requirements of the United States Department of Energy shall be employed. All persons shall comply with the security regulations of Argonne National Laboratory.

All persons visiting or performing work at the site are required to obtain a GATE PASS prior to entering the area.

Completion of DOE Form (ANL-593), Request for Foreign National Unclassified Visit of Assignment, will be required prior to issuance of a gate pass to any non-citizen who will be assigned by the contractor or sub-contractors to perform work under these specifications. All non-U.S. citizens will require a 593 to be processed by your ANL contact. Information required on the form includes:

1. Name of Visitor (Non- U.S. Citizen);
2. Alias;
3. Gender of Visitor (Male/Female);
4. City & Country of Birth;
5. Current Citizenship;
6. Date of Birth (Month/Day/Year);
7. Dual Citizenship (Y/N);
8. Current Employer Information (Name & Address);
9. Title or Position;
10. Type of Business (Contracting, etc.);
11. Education Background (Names of degrees, years degrees obtained & issuing institutions);
12. Field of Research; and
13. INS Documentation (LPR card, passport, visa & status documentation)

IMPORTANT NOTE: All non-U.S. citizens must present proof of legal status in the U.S. before access to the site will be granted.

NOTE: Processing may require as long as 7 business days for non-U.S. citizens and up to 2 months for citizens of the Embargoed or State Sponsors of Terrorism (T-4). See below for a complete list of Sensitive countries and Embargoed or State Sponsors of Terrorism (T-4) countries:

Sensitive Country List

<u>Algeria</u>	<u>Iraq</u>	<u>Pakistan</u>
<u>Armenia</u>	<u>Israel</u>	<u>Russia</u>
<u>Azerbaijan</u>	<u>Kazakhstan</u>	<u>Taiwan</u>
<u>Belarus</u>	<u>Kyrgyzstan</u>	<u>Tajikistan</u>
<u>China</u>	<u>Libya</u>	<u>Turkmenistan</u>
<u>Georgia</u>	<u>Moldova</u>	<u>Ukraine</u>
<u>India</u>	<u>North Korea</u>	<u>Uzbekistan</u>

Embargoed or State Sponsors of Terrorism (T-4 Countries)

<u>Cuba</u>	<u>Sudan</u>
<u>Iran</u>	<u>Syria</u>

SANITARY FACILITIES

Contractor shall provide sanitary facilities for all Contractor and Subcontractor personnel. Contractor shall ensure construction personnel do not use existing Laboratory sanitary facilities.

USE OF EXISTING UTILITIES

The Laboratory will make existing utilities such as water, steam and electricity available to the contractor without cost where such utilities are conveniently located with respect to the work site. The contractor must provide all materials, labor and equipment necessary for extending existing utilities to the point of use. The method of connection into existing utilities must be approved by the Laboratory and these connections to utilities shall be under the immediate supervisor of the authorized Laboratory representative. The contractor will be held responsible for the proper installation, operation and maintenance of temporary utilities and must adhere to all uniform codes governing such installations. Upon completion of the work, the Contractor shall remove all temporary utility lines and restore existing utilities to the original condition as directed by the Laboratory.

Prior to use of any 120 volt, single phase, 15 and 20 ampere receptacle outlet, the contractor shall install or cause the installation of a UL approved ground fault circuit interrupter for personnel protection.

SUPERVISION BY CONTRACTOR

The contractor shall, at all times during the progress of the work, provide a competent supervisor. This supervisor shall be vested with the necessary authority to direct and schedule the work and represent his firm in matters that may be referred to him by the Laboratory Project Manager.

SCHEDULING OF WORK

Shutdowns of utilities may be performed during normal Laboratory working hours unless otherwise instructed by the Laboratory. **Contractor to provide appropriate manpower and/or extended work hours to keep the shutdowns within the durations indicated on the proposed construction schedule.**

Allow latitude for coordination with Laboratory experimental schedules. Upon approval of the schedule, rigorously enforce the approved dates.

Use of large horsepower tools must be scheduled with the Laboratory.

Reference Section 01 31 00 for detailed schedule requirements.

Daily Report

The contractor shall make a daily written report to the Laboratory showing the following:

- Contract Number;
- Contract Name;
- Contractor Name;
- Number of Employees, by Craft, Listed by Contractor, Subcontractor, and Lower Tier Subcontractors;
- Names of Supervisors;
- Description of Work Performed, by Location;
- Description of Work prohibited or delayed due to weather conditions;
- Major Material/Equipment Items delivered to site;
- Description of unexpected delays which occurred or delays that are anticipated; Indicate the steps taken to offset the delay(s);
- Log of Visitors to the site;
- Inspections and Tests Performed;
- Safety Problems, if any, Including Corrective Action Taken;
- General Comments;
- Injuries, Including First-aid Cases; and
- Contractor Superintendent's Signature.

Time Extensions

In addition to the provisions of the various applicable Clauses of Appendix A, Argonne Terms and Conditions, any delay to one or more scheduled activities that is due to either acts or omissions to act by the Laboratory, shall be treated as follows:

- Time extensions granted to the Contractor by the Laboratory as the result of an equitable adjustment of the Contract shall apply to interim milestone dates and/or the Contract completion dates only to the extent that such adjustments apply to those activities affected by a Contract modification or excusable delay and only to the extent that such modifications and delays extend activity durations (critical and/or

non-critical activities) beyond the available float within such activities.

SHUT DOWNS

All shut downs shall be scheduled at least 72 hours in advance with Laboratory.

SUBMITTALS

General: Refer to General Conditions and Section 01 33 00 for general submittal requirements. Refer to each technical section for specific submittal requirements.

EXISTING WORK AND INTERRUPTION OF SERVICES

Protect existing work during construction. Do not interrupt any existing services without prior coordination and approval by the Laboratory. Nothing in this Contract shall be construed to permit any action which would endanger existing equipment, facilities or the continuity of services. Any damage occurring in the progress of this work shall be repaired as a part of the Contract with no increase in Contract price.

Perform all patching of existing structure. Provide all equipment supports. Contractor and his Subcontractors of any tier are to be responsible for restoration of existing conditions to the satisfaction of the Laboratory.

DELIVERY AND STORAGE

Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and labeled with the following information:

- Name and title of material;
- Federal Specification Number;
- Manufacturer's stock number and date of manufacturer;
- Manufacturer's name;
- Contents by volume for major pigment and vehicle constituents;
- Thinning instructions;
- Application instructions; and
- Color name and number.

All flammable material shall be stored in labeled safe enclosures, and handled to prevent fire hazards. Waste materials and solvent shall be removed from the project promptly to minimize fire hazard. Contractor shall regularly inspect premises during painting operations to assure safe handling of all hazardous materials.

DISPOSAL OF EXCESS MATERIALS, EQUIPMENT AND DEBRIS

All other excess materials, equipment and debris shall be disposed or recycled as per requirements of Section 1AO-General Conditions and Specification Section 01 74 19.

VERIFICATION OF SITE

Offerors shall visit the site and verify all applicable conditions likely to affect the work under this Contract. Proposals shall include all incidental items as required to complete the work specified or shown in the contract documents.

ACCESS TO THE SITE

The main entrance to Argonne National Laboratory is through North Gate. Gate passes are issued at the Visitors Reception Area located at North Gate. All construction employees and construction deliveries should be made through North Gate. Special exceptions may be made upon request and approval. Northgate is open at all times. Construction deliveries should never be made to the Argonne Receiving Department in Building 46.

WORK HOURS

Normal work hours are from 7:00 a.m. to 3:30 p.m., Monday through Friday. The Contractor must request and receive written authorization from the Laboratory to work outside of these hours. Written request for scheduled overtime must be received a minimum of 24 hours prior to the requested start of the work.

PRE-CONSTRUCTION MEETING

A pre-construction meeting will be scheduled by the Laboratory to occur within one week after the construction contract is awarded but prior to start of any construction work. Reference Section 01200 for detailed requirements and Contractor pre-requisites.

The meeting will cover but will not necessarily be limited to the following items:

- Laboratory Direction for Contractor;
- Changes to Contract;
- Work Entry Permits;
- Construction Schedule;
- Submittal Procedure;
- Temporary Protection;
- Material Storage;
- Fire, Safety, and Security Procedures;
- Payment Request Procedures;
- OSHA Requirements;
- As-Built Drawings;
- Emergency Off-Hour Contacts;
- Final Project Acceptance Procedure; and
- Contractor's Environment, Safety and Health (ES&H) Program and Implementation Plan.

END OF SECTION

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SECTION 01 01 00
OWNER FURNISHED/CONTRACTOR INSTALLED EQUIPMENT

1.0 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of construction of the Energy Sciences Building at Argonne National Laboratory in Argonne, Illinois, in accordance with the Contract Documents.

1.2 CONTRACTORS USE OF PREMISES

- A. Confine operations on the site to areas indicated.
- B. Do not unreasonably encumber the site with materials or equipment.
- C. Do not overload the structure with weight that would endanger it.
- D. Assume full responsibility for protection and safekeeping of materials and tools stored at the site.
- E. Obtain and pay for use of additional storage space or work areas need for construction operations.

1.3 OWNER FURNISHED/CONTRACTOR INSTALLED ITEMS

A. Submittals

1. Obtain all necessary information from Laboratory as to manufacturer, model, and type of each Owner Furnished Contractor Installed item furnished by Laboratory.
2. Submit shop drawings, in accordance with the requirements of Section 01 33 00, showing dimensioned rough-in diagrams for each OFCI item requiring utility connections, dimensioned locations of backing plates required in walls and partitions, and details of connections to supports of all OFCI items.

B. General

Contractor is responsible for correct and properly located installation of the OFCI items in accordance with the various manufacturer's specifications and instructions.

1. If a conflict occurs between manufacturer's instructions and actual field conditions, do not install the affected items until the conflict is resolved. No extra payment will be made to the Contractor for correction of improper installation of OFCI items when reasonably adequate data and instructions for installation were furnished by Laboratory or various OFCI item manufacturers.
2. OFCI items will be delivered FOB jobsite. Contractor shall receive and unload OFCI items, place in covered storage or enclosed building, and be responsible therefore after delivery. OFCI items that are damaged, abused, lost, or stolen while in the Contractor's custody and control or damaged or defaced during installation shall be repaired, replaced, or otherwise made good to Laboratory 's satisfaction at the Contractor's expense.

3. Immediately after delivery of the OFCI items, open and uncrate the items for inspection (note subsection 1.3.B.5 below). Laboratory and the Contractor shall inspect each item and maintain a written record of all damage, missing parts, and other defects disclosed, all of which will be made good by Laboratory. After the inspection, Contractor shall be solely responsible for the equipment as specified above.
4. Contractor may request and receive from Laboratory any necessary additional information, such as specifications, templates, and like items from any of the manufacturers of the OFCI items. The Contractor may request a manufacturer's representative to supervise installation of any OFCI item, but at no extra cost to Laboratory.
5. Contractor shall be responsible for complying with all cleanroom and clean-build protocol requirements as identified by the OFCI equipment manufacturers and the Contract Documents as they pertain to tasks including, but not necessarily limited to, equipment receipt, inspection, storage, and installation.

C. Installation Materials

Provide attachments, fittings, fasteners, connectors, and other ancillary materials required to make complete workable installations.

D. Installation

Conform to each OFCI item manufacturer's specifications, templates, and information, including the necessary assembling of components or sub-assemblies.

1. Verify that space limitations, and mechanical and electrical services indicated and specified in other Sections are compatible with OFCI items.
2. Verify that modifications to OFCI items required to conform with space limitations or with utility services specified for rough-in shall not cause additional cost to Laboratory.
3. If Laboratory substitutes items similar to those scheduled, there shall be no change in rough-in cost, unless substitution occurs after rough-in has been completed or rough-in involves other mounting requirements, utilities or utilities are different capacity from that required by items originally specified.

1.4 LABELS

- A. Except for Code-required labels, equipment name-plates and similar labels containing manufacturers name, address, model number, capacity and other rating information which are securely attached to each piece of equipment, the installation of any item, element, or assembly which bears on any exposed surface the name, trademark, vendor, fabricator or other sources from which the product has been obtained, is prohibited.
- B. Also forbidden is the installation of any article which bears visible evidence that a name, trademark, or other insignia has been removed.

1.5 DEFINITIONS

- A. In addition to other definitions included in these Specifications, the following also apply to the Work:
1. "As shown", "as detailed", "as indicated", or other words of similar import refer to their use in relation to the Drawings.
 2. "As selected", "as approved" or words of similar import refer to selection or approval or acceptance by Laboratory.
 3. "Shall" refers to actions that are mandatory in nature.
 4. "As required" refers to actions that must be taken under the terms of the Contract Documents.
 5. "As necessary" refers to actions that are essential to the completion of the Work.
 6. "Concealed" means embedded in masonry, concrete, or other construction materials, installed within furred spaces, within a wall/partitions or above suspended ceilings, in trenches, in crawlspaces, or in enclosures.
 7. "Exposed" means not installed underground or concealed as defined above.
 8. "Product" refers to all materials, systems, and equipment.
 9. "Section" and "Division" refer to the specific Section or Division of these Specifications.
 10. "OFCl" refers to Owner-Furnished, Contractor-Installed.

END OF SECTION

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SECTION 01 02 50
UNIT PRICES

1.00 GENERAL

1.01 Requirements Included

- A. This section describes the method of pricing the change in the work for which the price is stated and which may be ordered as the Work progresses.
- B. The bidder agrees that if the quantities of Work shall change, the Contract Sum will be adjusted by an amount equal to the net difference of quantities multiplied by the agreed upon Unit Prices.

1.02 Related Requirements

- A. Drawings, Fixed-Price Construction Contract between UChicago Argonne, LLC. and Contractor including Exhibit "A", Division 0 Documents and other Division 1 Specification Sections, apply to this Section.
- B. Individual Specifications Sections stipulate pertinent requirements for products and methods to achieve the work required for each Unit Price.

2.00 SCHEDULE OF UNIT PRICES

- 2.01 Payment for additional work and credit for deductions in work ordered under the applicable provisions of Appendix A – Argonne Terms and Conditions and Technical Sections of the Specifications shall be computed in accordance with the prices defined on the Fixed-Price Construction Contract between UChicago Argonne, LLC. and Contractor.
- 2.02 The unit prices shall be all inclusive of cost of the labor, materials, waste, loss, breakage, damage, equipment, work, layout, technical/data submittals, shop drawings, coordination, drafting, overhead, profit, bond and any and all other costs associated for each of the items listed.
- 2.03 The calculations for determining the number of units of work shall be of actual surface, volume, length, hours or number of individual items listed for the class of work, complete in place and accepted or omitted. No allowance for waste, loss, breakage or damage will be made.
- 2.04 The unit prices to be bid upon for each Subsystem are listed on Attachment 2 to the Bid Form.

END OF SECTION

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SECTION 01 04 00
PROJECT COORDINATION

1.00 GENERAL

1.01 PROJECT COORDINATION

- A. The Contractor shall recognize the complex nature of the Project, the sequential nature of the Work and the concurrent operations of all Contractors and Subcontractors.
- B. The Contractor shall become thoroughly familiar with the requirements of Division 1, Schedule of Dates, and scope of work of his Subcontractors and make any adjustments necessary to maintain his Detailed Construction Schedule. (Also sometimes called Detailed Project Schedule, Detailed Schedule, Project Schedule, The Schedule, CPM Schedule, and Schedule and the Project Master Schedule.)
- C. Close coordination will be required of the Contractor with Laboratory or Laboratory's Designated Representative, Architect, Subcontractors, and others having an interest in the Project:
 - 1. to assure that Work on the site, access to and from the site and the general conduct of operations is maintained in a safe and efficient manner;
 - 2. and that disruption and inconvenience to existing streets and property is minimized; and
 - 3. that the Project Master Schedule is maintained in an orderly and efficient manner.

1.02 OCCUPIED AREAS

- A. During the construction period contemplated for the Work described herein, adjacent streets and properties will remain in use.
- B. Adjacent properties shall be off-limits to all construction personnel.

1.03 MAINTAINING STREET SERVICE and ACCESS

- A. The Contractor and his Subcontractors of any tier shall be subject to such rules and regulations for the conduct of the Work as Laboratory or Laboratory's Designated Representative may establish.
- B. The Contractors Work must minimize disruptions or disturbances to the adjacent street users and property Laboratory's.

- C. Construct the Work in stages to provide for public convenience. Do not close off public use of a street until completion of one stage of construction will provide alternative usage, if possible, and always through the coordination of Laboratory or Laboratory's Designated Representative.
- D. The Contractor shall not block, obstruct or impede access through any designed jobsite entrance at any time without Laboratory or Laboratory's Designated Representative's prior approval.
- E. No interruptions to the work of Laboratory or Laboratory's Designated Representative will be permitted without the prior written permission of Laboratory or Laboratory's Designated Representative. Arrangements for work interruptions shall be made with Laboratory or Laboratory's Designated Representative at such times and for durations as authorized by him.

1.04 COORDINATION WITH LABORATORY OR LABORATORY'S DESIGNATED REPRESENTATIVE

- A. Observation of Work by others shall not be interpreted as relieving the Contractor from his responsibility for coordination of his Work with the Work of others, superintendency of his Work, sufficiency of his work, or scheduling and direction of his Work.
- B. The Contractor shall provide full-time on-site Project Manager and Superintendent and such other personnel as required to properly manage the Project. Verifiable qualifications of the Project Management Team (Project Manager, Superintendent and Safety Manager) and Scheduler (See Section 01 31 00) must be submitted to Laboratory or Laboratory's Designated Representative for approval prior to the start of the Work. After approval the Project Manager, Superintendent and Scheduler shall remain assigned to the Project until it is substantially complete or until such time as Laboratory or Laboratory's Designated Representative approves their removal and/or replacement.
- C. The duties of the Contractors' Project Manager, Superintendent, and Scheduler shall include but not be limited to:
 - 1. Coordination and liaison with all other Contractors, Architect, and Laboratory or Laboratory's Designated Representative.
 - 2. Plan and supervise all Contractor field operations.
 - 3. Direction of all administrative and management requirements for the control of time and cost. The Project Manager and Superintendent shall be vested with the power, authority, experience and confidence needed to make binding decisions for the Contractor.

1.05 COORDINATION WITH CONTRACTORS

- A. As various areas or parts of the site and buildings are complete, or otherwise suitable for the subsequent contractors to commence work, those contractors shall be allowed to deliver materials and must start work. Such phased commencement shall be in accordance with the Project Master Schedule. Prior to commencing work at any area or part, certain contract requirements shall be met for that area or part, such as verification of conditions as specified.
- B. All Contractors are to coordinate their work with the work of the other Contractors for proper function and sequence to avoid construction delays.
- C. The Contractor shall maintain free access to all buildings and areas to the site for emergency vehicles, service vehicles, and fire fighting equipment and at no time shall block off or close roadways or fire lanes without providing auxiliary roadways and means of entrance acceptable to Laboratory or Laboratory's Designated Representative. Adjacent fire hydrants, if any, must remain accessible at all times. The Contractor shall give Laboratory or Laboratory's Designated Representative and the Laboratory Fire Department at least forty-eight (48) hours notice of need for any such changes or alternate project access routes.

1.06 CONTRACTORS RESPONSIBILITY FOR COORDINATION

- A. All Contractors shall work similar hours in performing the Work under an orderly and systematic means. Normal work hours for the Project are as indicated in Section 01001, "Special Conditions".
- B. Whenever the Contractor intends to depart from normal work hours, he shall notify Laboratory or Laboratory's Designated Representative at least forty-eight (48) hours in advance. Failure of the Contractor to give such timely notice may be cause for Laboratory or Laboratory's Designated Representative to require the removal or uncovering of work performed without the knowledge of Laboratory or Laboratory's Designated Representative.
- C. The Contractor shall work so as to proceed without delay and to maintain Schedule dates. All operations shall be conducted so as to comply with all applicable laws, ordinances, and regulations.

1.07 EXISTING UTILITIES and SERVICES

- A. Utilities and/or other services which are shown or not shown but encountered, shall be protected by the Contractor from any damage from any work and/or operations of the contract, unless or until they are abandoned. If any utilities or services are not abandoned at time of damage, the Contractor shall be responsible for the repair of any damage from his work and/or operations and for restoration of the utilities

and services to an equal or better condition that which existed prior to the damage as directed.

- B. The Contractor and his Subcontractors of any tier shall be responsible for all damage to the Project buildings, facilities, and grounds due to his operations. Repair or replacement of damaged items shall be to the satisfaction of Laboratory and Laboratory's Designated Representative.

1.08 COORDINATION SHOP DRAWINGS

- A. The Contractor shall establish a program for the preparation and submittal of coordination shop drawings. The Contractor's program shall ensure that all work, including but not necessarily limited to all ductwork, piping, plumbing, fire protection, electrical, instrumentation, voice and data raceway, and breechings installed shall be fully coordinated and meet all Contract Document requirements.
- B. The Contractor's coordination shop drawing program shall include the requirement that coordination drawings shall be prepared at a minimum scale of 1/4" per foot and shall include sufficient detail to demonstrate to Laboratory or Laboratory's Designated Representative that all work installed shall meet the requirements of the drawings and specifications and has been fully coordinated.
- C. The Contractor shall, within 14 calendar days of contract award, submit a detailed description of its coordination shop drawing program for review and approval by Laboratory or Laboratory's Designated Representative. Laboratory or Laboratory's Designated Representative will complete its review of the program within 14 days of receipt. Contractor shall resolve comments and implement the program.
- D. Any equipment, material, or other items brought onto the project work site without prior review and acceptance of shop drawing submittals shall be subject to removal from the site at the discretion of Laboratory or Laboratory's Designated Representative at the expense of the Contractor. Reference Section 01 33 00 for submittal requirements.
- E. Any equipment, material, piping, sheet metal or conduit installed without prior shop drawing submittal, review, and acceptance shall be subject to removal and replacement at the discretion of Laboratory or Laboratory's Designated Representative at the expense of the Contractor. This includes any material installed without prior submission and acceptance of the required coordinated to scale plans and sections to be produced and coordinated by all trades. Reference Section 01 33 00 for submittal requirements.

END OF SECTION

SECTION 01 04 50
CUTTING AND PATCHING

1.00 GENERAL

1.01 REQUIREMENTS INCLUDES

- A. Cutting, fitting, and patching, including attendant excavation and backfill, required to complete Work or to:
1. Make its several parts fit together properly;
 2. Uncover portions of the Work to provide for installation of ill-timed work;
 3. Remove and replace defective work;
 4. Remove and replace work not conforming to requirements of Contract Documents;
 5. Remove samples of installed work as specified for testing; and
 6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
- B. Cutting, Patching, Openings in New Construction:
1. Openings in new construction required for plumbing, heating/air conditioning, ventilating and electrical work shall be provided by the Contractor requiring the opening.
- C. Cutting, Patching, and Openings in Existing Construction:
1. Openings in existing construction required for plumbing, heating, air conditioning, ventilating, and electrical work shall be provided by each respective Contractor.
 2. Patching and finishing shall be provided by each Contractor and shall match the existing surfaces and include the refinishing of the entire surface, including painting, i.e., from corner to corner and floor to ceiling of walls.
- D. Inserts:
1. Each respective Trade Contractor shall provide all inserts, sleeves, hangers, boxes, and other accessories as required for the installation of his work.
 2. Inserts shall be set in proper positions and be so maintained during construction.

3. In the event that timely delivery of inserts and other accessories cannot be made, and to avoid delay, boxes or other forms shall be set where permanent material is to be installed.
4. Upon subsequent installation of permanent items they shall be filled around with materials as required by Contract Documents provided by the Contractor requiring the penetration.

1.02 SUBMITTALS

- A. Submit a written request to Laboratory or Laboratory's Designated Representative and copy the Architect well in advance of executing any cutting or alteration which affects:
 1. Work of any Contractor;
 2. Structural value or integrity of any element of the Project;
 3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems;
 4. Efficiency, operational life, maintenance or safety of operational elements; and
 5. Visual qualities of sight-exposed elements.
- B. Request shall include:
 1. Identification of the Project;
 2. Description of affected work;
 3. The necessity for cutting, alteration or excavation;
 4. Effect on work of Laboratory or any separate contractor or on structural or weatherproof integrity of Project;
 5. Description of proposed work:
 - a. Scope of cutting, patching, alteration, or excavation;
 - b. Trades who will execute the work;
 - c. Products proposed to be used; and
 - d. Extent of refinishing to be done.
 6. Alternatives to cutting and patching;

7. Cost proposal, when applicable; and
 8. Written permission of any separate Contractor whose work will be affected.
- C. Should conditions of Work of the schedule indicate a change of products from original installation, Contractor shall submit request for substitution.
- D. Submit written notice to Laboratory or Laboratory's Designated Representative and copy the Architect designating the date and the time when work will be uncovered.

END OF SECTION

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SECTION 01 05 00
SURVEY & FIELD ENGINEERING

1.00 GENERAL

1.01 LINES and LEVELS

- A. The survey furnished by Laboratory will identify the property line and permanent bench marks.
- B. NOT USED
- C. Contractor shall preserve survey control monuments, reference points, project control points, and bench marks unless directed otherwise by Laboratory or as noted in the contract.
- D. Establish control points and bench marks adequate for the use of all trades for reference so that all parts of the work will be within the tolerance specified or standard within the industry, when not specified.
- E. Any property corner or public land corner that is destroyed or disrupted by construction operations shall be reestablished by a qualified licensed surveyor at the expense of the Contractor causing said damage.
- F. Maintain firm control points and bench marks in all undisturbed condition until final acceptance by Laboratory.
- G. Discrepancies found at any time shall be reported to the Laboratory or Laboratory's Designated Representative immediately.

1.02 PROJECT RECORDS and SUBMITTALS

- A. The Contractor shall prepare survey notes and records for staking and layout, and furnish Laboratory with certified original notes, drawings, calculations, and cut sheets. Additional copies of the survey shall be furnished to Laboratory at their request.
- B. The Contractor shall submit name and address of Engineer or Surveyor along with a signed certificate stating that all elevations and locations of improvements are in compliance with the contract.

END OF SECTION

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SECTION 01 05 10
LAYOUT OF THE WORK

1.00 GENERAL

1.01 PROJECT LAYOUT

- A. These Contract Documents have been prepared for the purpose of an contract award to qualified Contractors. Contractor shall review the Documents and immediately advise Laboratory or Laboratory's Designated Representative of any adverse factor which might affect the execution of this Work. Contractor will, if no objections are noted, agree to incorporate into his Contract, and coordinate work with the requirements of all subsequent documents.

1.02 COORDINATION WITH OTHERS

- A. Contractor shall recognize the need to obtain accurate field dimensions in ample time to permit fabrication of certain items (i.e., casework, cabinets, and other work) and allow for delivery and installation in time to maintain the construction schedule. The Contractor and all subcontractors shall cooperate in completing work phases to accommodate the schedule for obtaining dimensions and to prevent fabrication delay. In the event it is impractical to have work in place to permit field measurements, the Contractor shall guarantee necessary dimensions before construction to the various fabricators and be responsible to insure the dimensions.
- B. Verify measurements at the site. No extra charges shall be allowed for differences between dimensions shown and actual measurements. Advise Laboratory or Laboratory's Designated Representative of any differences noted. Do not provide filler pieces or closures without approval.
- C. Contractor shall furnish approved copies of all information (i.e., shop drawings, diagrams, templates, tech data, etc.) to Subcontractors and Laboratory or Laboratory's Designated Representative as required for the purpose of coordination of the Work.
- D. Contractor shall protect and preserve the established control points, monuments, stakes, benchmarks or other datum points. The Contractor shall make no change in locations without the written approval of Laboratory or Laboratory's Designated Representative. Any of the control points which might be lost or displaced, through the neglect of the Contractor, shall be replaced at his cost.

1.03 CONTRACTORS EXECUTION

- A. Contractor shall employ qualified personnel to stake out/locate the reference points as needed to properly locate his Work as well as his subcontractors Work. All significant points and benchmarks identified by Contractor shall be preserved for use by his Subcontractors.

- B. Contractor shall verify the overall and critical dimensions and elevations for his Work prior to commencing the Work.
- C. All Work, and in particular piping, ducts, conduit, and similar items, shall be neatly and carefully laid out to provide the most useful space utilization and the most orderly appearance. Except as otherwise indicated or directed, piping and similar work shall be installed as close to ceilings and walls as conditions reasonably permit. These items shall be located to prevent interference with other work and with the use of the spaces in the manner required by the functions of the space and Laboratory. Valves shall be located in inconspicuous, but accessible locations before proceeding with any Work where exposed to view. The Contractor shall carefully plan the layout and review any questionable installations with Laboratory or Laboratory's Designated Representative.
- D. Except as provided above, each Contractor shall examine the conditions under which the Work is to be installed and notify Laboratory or Laboratory's Designated Representative in writing of any discrepancies or conditions detrimental to proper performance of the Work. No Contractor is to proceed until the required corrections are accomplished. Each Contractor shall be responsible for the correct location, dimensions and elevations of his Work. As the Work progresses, the Contractors shall layout the exact locations of the Work as a guide for all trades.

1.04 COORDINATION

- A. Refer to Specification Section 01 04 00 for Coordination Requirements.

END OF SECTION

SECTION 01 06 00
REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Fixed-Price Construction Contract between UChicago Argonne, LLC and Contractor, including Exhibit "A", Division 0 Documents, and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Fixed-Price Construction Contract between UChicago Argonne, LLC and Contractor.
- B. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. There is no limitation on location.
- C. Regulation: The term regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- D. Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- E. Install: The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- F. Provide: The term provide means to furnish and install, complete and ready for the intended use.
- G. Installer: An Installer is the Trade Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term "experienced," when used with the term "Contractor" or "Installer" means having a minimum of three previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

2. Trades: Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.
 3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no choice or option. However, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor's.
 - a. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.
- D. Project Site is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- E. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

- a. The words "shall be" are implied wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. **Applicability of Standards:** Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. **Publication Dates:** Comply with the standards in effect as of the bid due date or as referenced in applicable Building Codes.
- C. **Conflicting Requirements:** Where compliance with two or more standards is specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to Laboratory or Laboratory's designated representative for a decision before proceeding.
 1. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to Laboratory or Laboratory's designated representative for a decision before proceeding.
- D. **Copies of Standards:** Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.
- E. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

- A. Do not perform Work which is known to be, or which the Contractor or subcontractor is in a position to know, is contrary to applicable regulatory requirements which include, but are not necessarily limited to the building codes and regulations identified in the Contract Documents.

1.6 SUBMITTALS

- E. Permits, Licenses, and Certificates: For Laboratory or Laboratory's Designated Representative and the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 01 18 00
PROTECTION OF WORK AND PROPERTY

1.00 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings, Fixed-Price Construction Contract between UChicago Argonne, LLC and Contractor including Exhibit "A", Division 0 Documents, and other Division 1 Specification Sections, apply to this Section.

1.02 REQUIREMENTS INCLUDED

- A. Protection of Work and Property.

1.03 PROTECTION OF WORK AND PROPERTY

- A. The Contractor shall continuously protect the work and the work of others, including without limitation, property adjacent to the site, from damage, injury or loss arising from the Contractor's work and operations. The Contractor shall employ only methods of construction of erection that conform to OSHA regulations and local, State, and Federal safety laws and codes which provide adequate protection to the work and to the property of Laboratory and others.
- B. The Contractor shall confine his construction equipment, the storage of materials, and the operations of workmen to the limits indicated by laws, ordinances, permits, and as may be established by Laboratory or Laboratory's Designated Representative, and shall not unreasonably encumber the premises with construction equipment or materials.
- C. The Contractor shall remove all snow and ice as may be required for the proper protection and execution of his work. The Contractor shall, at all times, provide and maintain adequate protection against weather, so as to preserve his work, materials, equipment, apparatus, and fixtures free from injury or damage.
- D. The Contractor shall remove and dispose of all trash and debris in a timely and safe manner. Accumulation of trash, debris or construction materials that could constitute a fire or safety hazard within the structure or on the site, shall not be allowed. The Contractor shall, if so directed by Laboratory or Laboratory's Designated Representative, immediately remove and dispose of any materials that create a fire or safety hazard.

Laboratory, if the Contractor fails to take appropriate and immediate action (in the Laboratory's opinion), shall have all such materials removed from the site and disposed of at the Contractor's expense.

- E. Welding, flame cutting or other operations involving the use of flame, arcs or sparking devices will not be allowed without adequate protection and shielding, particularly at the point of operation and without prior approval by Laboratory or Laboratory's Designated Representative. All combustible and flammable material shall be removed from the immediate work area. If removal is impossible, all flammable or combustible materials shall be protected with a fire blanket or suitable non-combustible shields to prevent sparks, flames or hot metals from contacting the flammable or combustible materials. Contractor shall provide the necessary fire watch personnel and fire fighting equipment to effectively control incipient fires resulting from welding, flame cutting or other operations involving the use of flame, arcs or sparking devices.
- F. The Contractor, as necessary for his work, shall provide flagmen and erect proper barricades and other safeguards, and post danger signs and other warnings as may be required due to hazards or existing conditions effecting the performance of the work.
- G. Laboratory shall provide project security only to the extent of fences with locked gates or doors around the perimeter of the site. Each Contractor shall be responsible for the security of its own property.

END OF SECTION

SECTION 01 20 00
PROJECT MEETINGS

1.00 GENERAL

1.1 PRE-CONSTRUCTION MEETING

- A. Before beginning the work and after the Contract has been awarded the Laboratory will schedule a Pre-Construction Meeting to discuss: work entry, and other permits, daily manpower accountability, tool inspections, barricades, work hours, weekly tool box meetings, competent persons, postings, laydown areas, show drawings, temporary facilities and utilities, construction schedules and procedures, development of a plan for utility protection and reconstruction, arrangements for orderly movement of traffic, Contractor's use of the site, Contractor's movement of traffic, Contractor's use of existing facilities, Laboratory's regulations, including Environment, Safety, and Health and OSHA requirements, Project Record Documents and other matters deemed relevant to the effective performance of the work and as described in these specifications.
- B. Requirements for Meeting. The Pre-construction Meeting will not be held until the Contractor has:
1. Submitted his Contractor's Environmental, Safety, and Health (ESH) Program and Implementation Plan/Job Safety Analysis per Appendix A;
 2. Submitted all other pre-construction submittal requirements described in the contract requirements; and
 3. Submitted Contractor's construction schedule and sequence as specified in Section 01 31 00.
- C. The meeting shall be attended by:
1. The Contractor's Project Manager/Key Office Representative;
 2. The Contractor's Field Superintendent and ESH representative;
 3. Any subcontractor's or supplier's representative whom the Contractor may desire to invite or Laboratory may request; and
 4. Laboratory Personnel.

1.2 PROGRESS MEETINGS

- A. Weekly project meetings will be held at the job site by Laboratory or Laboratory's Designated Representative for the purpose of coordinating and expediting the Work in Progress. The duties of the Contractor's Project Manager, Superintendent, and Scheduler shall include direction of all administrative and management requirements for the control of time and cost. The Project Manager and

Superintendent shall be vested with the power, authority, experience and confidence needed to make binding decisions for the Contractor.

A partial agenda follows:

- a. Review of previous Meeting Minutes (Old Business);
 - b. Schedule:
 - (1) Review of actual progress compared to Contractor's project schedule;
 - (2) Review of Short Interval Schedule (reference Section 01 31 00.); and
 - (3) Review delivery dates for specific equipment and materials.
 - c. Shop Drawings and Samples:
 - (1) Review the status of shop drawings and sample submittals and
 - (2) Review of approved shop drawings affecting other trades.
 - d. Change Orders:
 - (1) Review of latest Contract changes and
 - (2) Review status of Pending Change Orders and Work Authorizations
 - e. Review the status of Requests for Information (RFIs);
 - f. Review of specific coordination or construction problems;
 - g. Review Items of General Conditions;
 - h. Weekly work requirements;
 - i. Safety;
 - j. Laboratory or Laboratory's Designated Representative, Architect, and Contractor comments; and
 - k. Other Business.
- B. Special meetings may also be called at the discretion of Laboratory or Laboratory's Designated Representative for the purpose of coordinating specific information or resolving special problems related to Project.
- C. Each Contractor who has work in progress will be represented at the progress meeting by the Field Superintendent or Project Manager.
- D. The essence of the discussion of each meeting will be entered into the minutes and copies will be furnished by Laboratory or Laboratory's Designated Representative to all interested parties within one week.

END OF SECTION

SECTION 01 31 00
CONSTRUCTION SCHEDULE

1.0 GENERAL

The following schedule requirements modify and/or supplement Clause 28 in “Appendix A – Argonne Terms and Conditions” and “Section 1A0 – General Conditions”.

1.1 SUMMARY

- A. The work under this contract will be planned, scheduled, executed, and reported using Critical Path Method scheduling (hereinafter referred to as CPM). The construction schedule will be developed using a CPM schedule demonstrating complete fulfillment of all contract requirements. The CPM schedule (both the working and baseline versions) shall be kept up-to-date in accordance with the requirements of this section and utilized in planning, coordinating, and performing the work under this contract (including all activities of subcontractors, equipment vendors and suppliers). The CPM schedule will be in precedence format, computer generated and updated using Oracle Primavera P6, and the controlling schedule document utilized for managing construction and measuring performance.
- B. It is expressly understood and agreed that the time of beginning, the rate of progress, and the time of completion of the work are of the essence to this Contract. Therefore, the primary objectives of CPM scheduling are to insure the adequate planning, scheduling, and execution of the construction activities so they may be performed in an orderly and expeditious manner within the Schedule of Dates stipulated by the Contract, to provide optimum coordination of the work, to establish the basis for measuring and monitoring contractor progress, to detect problems for the purpose of taking corrective action, to provide a mechanism or tool for determining and monitoring such corrective actions, and to be used as the basis for determining the schedule of values, payment schedule and progress payments.
- C. Definitions:
1. Activity - Any portion or element of work, action, and/or reaction that is precisely described, readily identifiable, and is a function of a logical sequential process.
 2. Baseline Schedule - Represents the approved plan against which the project's actual performance – with respect to accomplishing the work scope contained within each detail activity – is measured. This baselined information will be integrated with performance reporting software to obtain the planned value and, when combined with actual performance, will be the basis for a formal performance reporting system. Once the CPM schedule is approved by Laboratory or Laboratory's Designated Representative (Laboratory), it will be considered baselined. At this time, the dates, resource costs, activity codes, work breakdown structure, and activity descriptions are no longer subject to any changes unless these changes are part of a documented and approved change control process (see Section 1.9 Schedule Revisions).
 3. Construction Schedule - Same as CPM schedule.

4. CPM Schedule - The schedule developed by the Contractor and approved by Laboratory that will be used for managing and monitoring the progress of the contract. This is a plan that defines when specified work is to be done to accomplish program objectives on time.
5. Float Time - Float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity in the project schedule. Total float is defined as the amount of time any given activity or path of activities may be delayed before it will affect the project completion time. Float is not time for the exclusive use or benefit of either Laboratory or the Contractor, but must be used in the best interest of completing the project on time. The Contractor shall proceed according to the early start dates unless circumstances prevent. Once an activity has been started the Contractor shall continue the work on that activity as scheduled until it is completed unless circumstances prevent. Laboratory reserves the right to request a report on such circumstances that delay the start of activities or require their suspension. Laboratory may require the Contractor to proceed utilizing the early dates if the circumstances are not justified in Laboratory's opinion. Laboratory will not be responsible for delays caused by the Contractor not proceeding per the early start dates or suspending the work if such actions were within Contractor's control. If in Laboratory's opinion the delay/suspension is justifiable, Laboratory shall authorize the Contractor to prepare a supplemental or 'what if' schedule for Laboratory's approval including all activities in the CPM schedule necessary to clearly represent the impact. Pursuant to the float sharing requirements as set forth above, (1), use of float suppression techniques such as preferential sequencing, special lead lag logic restraints, extended Activity durations or imposed dates and (2), use of float time disclosed or implied by the use of alternate float suppression techniques shall be shared to the proportionate benefit of Laboratory, Laboratory's CM, Architect, Engineer, contractors, and subcontractors. The Contractor shall revise the Contractor's CPM schedule as reasonable to mitigate the impact of delays to the project with no change in Contract price. Extensions of time for performance required under the General Conditions pertaining to equitable time adjustment will be granted only to the extent that the equitable time adjustment exceeds total float in the activity or path of activities affected at the time notice to proceed was issued for the change.
6. Network Diagram - Graphical representation of relationships that exist between different activities of the CPM schedule drawn to time scale.
7. Percentage Complete - The physical percentage of completion, NOT the resource or duration percentage complete.
8. Precedence Method - Scheduling system where relationships between activities are expressed from start or finish of an activity to start or finish of the succeeding activity, with minimal use of lead or lag time.
9. Remaining Duration - Shall be equal to the factor of the remaining percentage of completion times the original as-planned duration, or as approved by Laboratory.
10. Supplemental Schedules - Those schedules that are not part of the baseline schedule hierarchy (working and baseline). They are often used for day-to-day

operational planning and management, and as the name suggests, simply supplement the baseline and working schedules, but are not under configuration control. This category would include “what-if” schedules generated to evaluate potential alternate management options.

11. Working Schedule - Once the baseline CPM schedule has been established, it will be necessary to update actual progress on a predetermined basis and compare it to the baseline CPM schedule. The Working Schedule is used for that purpose. The updated activities, when compared with the baseline dates, provide management with an indication of the schedule performance for the overall project. In addition, the information obtained from statusing will be integrated with other performance reporting software to obtain earned-value information for formal performance reports. It is important to note, that the Working Schedule and Baseline Schedule are not the same file within the scheduling software. They may be attached but at no time should the Baseline Schedule contain status.

1.2 QUALIFICATION REQUIREMENTS

The Contractor shall employ a person or retain the services of a consultant, (hereinafter referred to as Scheduler), for the duration of the contract with at least three (3) years of experience with CPM scheduling software applications similar to the requirements of this project (i.e., Oracle Primavera P6). The individual will, also, need at least two (2) years of experience with scheduling as it pertains to Earned Value Management (EVM). Said person(s) shall cooperate with Laboratory and shall be on-site as required, to monitor, modify, or update the CPM schedule (including baseline, working, and supplemental).

1.3 SUBMITTALS

- A. QUALIFICATIONS: Prior to commencing performance of the work required under this section, submit to Laboratory:
 1. The name and address of the proposed Scheduler;
 2. Information sufficient to show that the proposed Scheduler has computer facilities meeting the requirements specified; and
 3. A list of prior projects, not less than two (2), for which the proposed Scheduler has performed services similar to those required under this contract. Laboratory shall have the right to approve or disapprove the Scheduler proposed, or the performance of the requirements herein by the Contractor's own organization.
- B. SCHEDULE:
 1. INTERIM SCHEDULE: As soon as is practical, but no later than fourteen (14) calendar days following Contract Award, the Contractor shall submit to Laboratory a preliminary CPM schedule in precedence format detailing planned work, operations, and/or procurement activities for the first 120 days of construction. Laboratory will review the Contractor's submittal to ensure sufficient detail will be provided to support progress payments to be made while the baseline CPM schedule is being developed and approved. The Contractor's interim CPM schedule is a necessary tool for the proper execution of the

Contractor's work. Therefore, the Contractor will not be permitted to begin work or receive payment until the interim CPM schedule has been submitted and approved. The interim schedule shall be updated, while the baseline schedule is being developed.

2. **BASELINE SCHEDULE:** As soon as is practical, but no later than eight (8) calendar weeks following Contract Award, the Contractor shall submit to Laboratory a baseline CPM schedule in precedence format for the entire Contractor's construction work scope. The Contractor's CPM schedule is a necessary tool for the proper execution of the Contractor's work and against which all progress shall be measured. Therefore, the Contractor will not be permitted to begin work or receive payment beyond the interim CPM schedule until the baseline schedule has been submitted and approved. Activities comprising the interim schedule shall be included in the baseline schedule. The baseline schedule shall be used by the Contractor and Laboratory as the basis for evaluating changes and claims and for evaluation of Application for Payment. The Schedule of Values and the Payment Schedule shall be developed using the values indicated in the baseline schedule and organized in accordance with the Laboratory WBS.
3. **WORKING SCHEDULE:** Once CPM schedules have been approved by Laboratory, a reporting cycle will begin where the Contractor shall submit to Laboratory a statused CPM schedule. The Contractor's CPM schedule is a necessary tool for the proper evaluation of the Contractor's work performance. Therefore, the Contractor will not be permitted to receive payment until the statused CPM schedule has been submitted and approved.

C. **CONTENT:** The CPM schedules shall meet the following criteria:

1. All activities shown in the Interim schedule shall be cost loaded. Summary level planning activities for the balance of the work through completion shall also be included and cost loaded. Approximate duration for the summary planning activities shall be shown. Summary planning activities shall be replaced and expanded with detailed activities when the Interim schedule is incorporated into the Baseline schedule.
2. The Interim CPM schedule shall include those activities that are necessary to properly indicate:
 - a. The project will begin on the date of contract award and will be completed within the number of calendar days specified in the Contract Documents;
 - b. Approach to scheduling the remaining work areas or phases. Work for each major phase or area shall be represented by at least one summary planning activity such that the activities cumulatively indicate the entire Construction Schedule;
 - c. Approximate cost and duration for each summary planning activity shall be shown on the Preliminary Schedule and shall include Contractor's best estimate of the Work it represents; and
 - d. Procurement activities to be accomplished during the first 180 days of the Contract.

3. The following should be depicted for each activity in the CPM schedule:
 - a. Activity descriptions and identification codes shall be clear and concise. For example, work related to each activity should be limited to one work trade, one construction area, and/or one floor.
 - b. The beginning and end of each activity shall be readily verifiable.
 - c. All activity starts and finishes must be tied into the CPM schedule by logical restraints.
 - d. Activity numbers shall be unique and shall not change as revisions are made to the schedule.
 - e. Activities shall be assigned separate activity codes to create a Work Breakdown Structure (WBS) consistent with the Laboratory WBS to be provided to the Contractor. These activity codes may be used to:
 - i. Define specific performance responsibility by discipline or subcontractor;
 - ii. Define concise work areas, such as building, floor, site electrical, paving, etc;
 - iii. Identify phase of each activity;
 - iv. Identify the Specification Section for the activity; and/or
 - v. Integrate into the Laboratory WBS.
 - f. The durations of activities shall be expressed in whole working days.
 - g. An Laboratory global resource will be used to load cost resources on those activities with cost in the CPM schedule.
4. The level of detail of the CPM schedule shall be a function of the complexity of the work involved. Generally, no activity shall have a duration of longer than twenty (20) work days nor have a value of over \$20,000.00 without prior acceptance by Laboratory, except for procurement, delivery of equipment or materials, and concrete curing in the baseline schedule and summary planning activities in the interim schedule. The selection and number of activities will be subject to the approval of Laboratory. All durations shall be the result of definitive manpower and resource planning by the Contractor and Subcontractors to perform the work in consideration of the requirements of the Contract and the on-site work conditions. The twenty (20) work day limitation is not intended to impede or restrict Contractor's flexibility to properly plan and schedule the work.
5. The CPM schedule shall be based on and incorporate the WBS and provide a complete and detailed sequence of operations of the work within the time limits specified in the Contract including specified mandatory milestone dates.
6. Schedules shall indicate the relationship and time frames in which the various phases of the facilities will be made substantially complete and placed into service as indicated in the Contract Documents.
7. Schedules shall depict major components of the work and the sequenced relationships between major components and subdivisions of major components.

8. For all major equipment and materials fabricated or supplied for this project, the CPM schedule shall show a sequence of activities including:
 - a. Negotiation and execution of contracts between the Contractor and subcontractors associated with the Work;
 - b. Preparation of shop drawing and sample submissions;
 - c. Review of shop drawing and samples (allow for one resubmittal);
 - d. Shop fabrication and delivery;
 - e. Erection or installation;
 - f. Testing of equipment and materials;
 - g. Submittal of Operation and Maintenance Manuals; and
 - h. Training.
9. Responsibility Codes for each activity shall be identified with a single performing organization including interfaces with the work of other Contractors or agencies (i.e., Contractor, subcontractors, suppliers, utilities, Laboratory agencies, etc.). Contractor shall involve all such organizations in the development and management of the CPM schedule and shall secure their individual and collective express commitment to satisfy the requirements of the CPM schedule. In addition to identification of responsible organization, each activity shall have codes identifying CSI division, location by area, and, code fields to be maintained by the Contractor solely for the use of Laboratory.
10. Total planned value shall equal the total contract value. Activities shall have an assigned dollar value (cost loading) that shall cumulatively equal the Contract Amount. General Conditions, General Requirements, insurance, bonds, permits, and all other overhead costs and profit shall be identified and the corresponding dollar values indicated for each. Planned value each month shall equal the amounts reported in the Payment Schedule.
11. Resource requirements (labor by craft, commodity, type, equipment, services, etc.) shall be required for each activity. All crafts necessary to execute an activity must be shown. No more than five (5) crafts may be assigned to a specific activity. If more crafts are required, then the activity in question must be broken down into additional activities.
12. All CPM schedule activities shall utilize a five (5) day, one shift, work week calendar including established holidays. This calendar shall be in accordance with the Laboratory working day calendar. All work to be scheduled on a different calendar must be pre-approved by Laboratory and the calendar(s) must be provided to Laboratory for incorporation into Laboratory's Primavera P6 system.
13. The CPM schedule shall indicate a completion date for the project that is no later than the project's required completion date for construction. All activity durations shall be given in work days.
14. The CPM schedule shall contain constraints only for Contract milestones including the completion date. No other constraints shall be used.

15. Monthly anticipated adverse weather days shall be considered and included in the planning and scheduling of all weather affected work activities in order to complete all work within the Contract Dates.
 16. Contractor shall ensure that the schedule represents an accurate, efficient, reasonable, and feasible plan and method for accomplishing the work throughout the time of performance. While Laboratory will review the Construction Schedule, the schedule itself is the Contractor's, who has full responsibility for its preparation, content, revisions, and updating in accordance with the requirements of the Contract Documents.
 17. Abbreviations shall be fully described in legend attached to the CPM schedule.
- D. FORM: The CPM schedule shall be submitted in the following formats: 1) network diagram, 2) reports, and 3) electronic media.
1. The network diagram shall contain the following features:
 - a. The order and interdependencies of the Contractor's activities and the major points of interface or interrelation with the activities of others, including Specific Dates for completion;
 - b. Conformance with an identification of the specified mandatory milestone dates specified in the Contract Documents;
 - c. The activity ID code, description, remaining duration, percent complete and total float for each activity;
 - d. Delivery of Laboratory furnished material and equipment;
 - e. The critical path/paths for the project with said paths of activities being clearly and easily recognizable on a time-scaled network diagram. The relationship between all noncritical activities and activities on the critical path shall be clearly shown on the network diagram;
 - f. The network diagram shall be sorted and grouped by floor, area and responsibility for ease of understanding and simplification; and
 - g. All network diagrams shall be a 22" x 34" media with suitable notation relating the interface points among sheets or as approved by Laboratory.
 2. In addition to the Network Diagram, the contractor shall submit the following CPM schedule reports including all of the activities and sorted by activity number including the following information: Activity Number; Activity Description; Original Duration; Remaining Duration; Percentage Complete; Responsibility Code; APM Code; Early/Actual Start; Early/Actual Finish; Late Start; Late Finish; Total Float (except as specifically indicated otherwise). All reports shall be submitted on 8½" x 11" media or as approved by Laboratory.
 - a. The Precedence Report shall be per the above requirements and shall include this information for each activity, that activity's immediate predecessors, and that activity's immediate successors.
 - b. The Master Schedule Report shall be per the above requirements.
 - c. The Early Start Report shall be per the above requirements with the exception that it shall be sorted first by early start and then by responsibility code.
 - d. The Total Float Report shall be per the above requirements with the exception that it shall be sorted first by total float and then by early start.

- e. The Responsibility Report shall be per the above requirements with the exception that it shall be sorted and grouped by responsibility code and then by early start.
 - f. The Variance Report shall be per the above requirements with the inclusion of a comparison between the original as-planned CPM schedule and the current update, indicating the variances between the two.
 - g. The Monthly Progress Payment Report shall include all activities with the following information sorted by activity number:
 - i. Activity number.
 - ii. Activity description.
 - iii. Physical percentage of work.
3. The Contractor shall also submit the CPM schedule in native electronic data form, utilizing Primavera P6 scheduling software. The Contractor shall have the capability of furnishing data reports or sorts in the following formats/layouts acceptable to Laboratory:
- a. Activity listing by Activity ID Number;
 - b. Activity listing by early and late start and finish dates;
 - c. Activity listing by Work Breakdown Structure;
 - d. Critical Path for the project, with said path of activities being clearly and easily recognizable on the time-scaled network diagram;
 - e. Activity listing by responsibility code or subcontractor or specification section;
 - f. Actual start date for each activity begun;
 - g. Actual finish date for each activity completed;
 - h. Planned and remaining duration time for each activity;
 - i. Activity listing by total float;
 - j. The percent complete of each activity in progress or completed;
 - k. Planned and earned dollar value of each activity and the planned and earned dollar value each month;
 - l. Software produced time scaled network diagram; and
 - m. Software produced bar chart.

1.4 REVIEW AND ACCEPTANCE

- A. Laboratory will review the Contractor's schedule submittals, including logic diagrams and computer generated mathematical analysis for sound logic, constructability, and adherence to plans and specifications. Laboratory will assume that the Contractor has accurately correlated the CPM schedule in its entirety and its individual elements to the Contractor's and Subcontractor's as-bid project execution plans including but not limited to subcontracts, purchase orders, delivery dates, crew strategies, etc. Non-conformance of any of the Contractor or subcontractor project execution plans to the Contract Documents shall not relieve Contractor or his subcontractor of any of the requirements of the Contract Documents. Meetings will be held between Laboratory and Contractor to resolve any apparent conflicts between the Contractor's interim and baseline CPM schedule and the intent of the Contract Documents. The Contractor shall revise Contractor's CPM schedule as required by Laboratory and shall submit Contractor's revised CPM schedule to Laboratory within seven (7) days. Within ten (10) calendar days following submission of an acceptable schedule, the Contractor will provide three (3) copies of the Contractor's CPM Schedule Submittal as outlined in

Section 1.3 above. Acceptance by Laboratory of the Contractor's CPM schedule is advisory only and shall not relieve the Contractor of the responsibility for accomplishing the work within all of the Contract requirements, including but not limited to, each and every Contract-required Milestone and Completion date. Omissions and errors in the approved CPM schedule shall not excuse performance which is not in compliance with the Contract. Approval by Laboratory in no way makes Laboratory an insurer of the CPM schedule's success or liable for time or cost overruns flowing from its shortcomings. Laboratory hereby disclaim any obligation or liability by reason of Laboratory's approval of or acquiescence to the CPM schedule.

1.5 WEEKLY PROGRESS MEETING

- A. Once every week, on a day established by Laboratory, a meeting will be held to assess the progress achieved by the Contractor during the previous work week. The Contractor shall submit a bar chart indicating progress for the previous week (the Weekly Schedule Report) and the activities scheduled for the succeeding 2 weeks [the Short Interval Schedule (SIS)]. The Weekly Schedule Report shall indicate for each day of the preceding week the actual manpower for each activity which was in progress. This report shall be equal to the actual number of tradesmen which were working for the Contractor and each Subcontractor each day. The Weekly Schedule Report shall also indicate for each day the weather conditions, potential delays and inspections occurring on that day. The Weekly Schedule Report shall be a report derived from the CPM schedule which may be completed by hand providing that the handwriting is legible to Laboratory. The SIS bar chart shall be directly derived from the CPM schedule and shall include all information required for network diagrams with the exception of logic ties. All activities shown in this SIS will be identified by the same activity numbers and descriptions as shown in the CPM schedule.

1.6 PROGRESS REPORTING AND CHANGES

- A. Once each month, prepare and submit to Laboratory a revised CPM baseline schedule showing all approved changes in network logic, including but not limited to changes as the result of change orders and any changes in contract completion dates which have been approved by Laboratory within this section since the last revision of the CPM baseline schedule. If the Contractor desires to make changes in its method of operating and scheduling, the Contractor shall follow the procedures set out in Paragraph 1.9, Schedule Revisions of this Section.
- B. Once each month on the date specified, prepare and submit to Laboratory an updated CPM working schedule as outlined in Paragraph 1.3 above, including the following:
 - 1. Activities in progress or to be performed in the future, and the percentage complete of each activity;
 - 2. Critical path for the project based upon the latest update data; and
 - 3. Earned value for each activity.
- C. Once each month, on the date specified by Laboratory for submission of updated CPM schedule, submit those reports and network diagrams indicated in Paragraph 1.3 above.

- D. In addition to the foregoing, submit a typewritten narrative report once each month with the updated schedule. The narrative shall include:
1. A narrative report describing:
 - a. Description of actual work accomplished during the reporting period and causes of any variances from the baseline (positive or negative);
 - b. Any deviations or changes in the Payment Schedule during the reporting period;
 - c. What problems or changes are anticipated or expected by the Contractor and what is the Contractor's plan to deal with same so as to minimize or prevent any delay to completion; and
 - d. Description of work planned during the next period.
 2. A list of major construction equipment used on the work during the reporting period and any construction equipment idle during the reporting period;
 3. A total number of men by craft actually engaged on the work during the reporting period with such total stated separately as to office, supervisory, and direct labor;
 4. A list of contractor-supplied permanent plant materials, long lead items, and equipment indicating current availability and anticipated job site delivery date; and
 5. A list of proposed modifications, additions, deletions, and changes in logic or sequence to the approved construction schedule.
- E. In addition to the above, the Contractor may be required to submit at Laboratory's request, the following typewritten report:
1. A Critical Items Report - The Critical Items Report identifies items by cause and impact that are or will seriously affect the Contractor's progress or ability to perform work in accordance with the current CPM schedule. Such report will not be required more than once every fourteen (14) days and shall be furnished in sufficient detail to define the cause and potential impact of any actual or anticipated changes in material or equipment deliveries (Contractor or LABORATORY-furnished), manpower availability, weather conditions or other items critical to maintaining schedule.

1.7 PAYMENTS TO CONTRACTOR

- A. If the Contractor fails to submit the interim or baseline CPM schedule within the time prescribed, or the updated monthly CPM schedule within the time requested, Laboratory may withhold approval of progress payment estimates until such time as the Contractor submits the required schedules.

1.8 RESPONSIBILITY FOR COMPLETION

- A. If, in the opinion of Laboratory, the Contractor falls behind the progress schedule, the Contractor shall take any and all steps necessary to improve Contractor's progress at no additional cost to Laboratory, including cost impacts to other contractors, agencies or

Laboratory directly caused by Contractor's delay, including but not limited to the following:

1. Increase construction manpower in such quantities and crafts as will substantially eliminate the lag in scheduled progress;
2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate lag in scheduled progress; and/or
3. Resequence activities to achieve maximum practical concurrent accomplishment of work activities.

B. Laboratory may also require the Contractor to submit for approval and at no additional cost to Laboratory such supplementary recovery schedules as may be deemed necessary to demonstrate the manner in which the approved CPM schedule will be regained during the immediate subsequent pay period. The Contractor and Laboratory shall take following steps after determination of the requirement for a Recovery Schedule:

1. Within four (4) work days, the Contractor shall meet with Laboratory to prepare and complete the Recovery Schedule. The Contractor and major subcontractors shall provide Laboratory with such information as is required to assist in preparation of a Recovery Schedule. The Recovery Schedule shall represent the Contractor's best judgment as to how Contractor shall reorganize Contractor's work and resources so that Contractor may return to the CPM schedule within the immediate subsequent pay period. The Recovery Schedule shall be prepared to a similar level of detail as the CPM schedule and shall give a maximum duration of one (1) month which shall coincide with the pay period.
2. Within five (5) calendar days, the Contractor shall participate in a conference with Laboratory to review and evaluate the Recovery Schedule. Any revisions necessary as a result of this review shall be resubmitted by the Contractor for approval within two (2) work days after the conference. The approved Recovery Schedule shall then be the schedule which the Contractor shall use in planning, organizing, directing, coordinating, performing and executing the work (including all activities of subcontractors, equipment vendors and suppliers) for its one (1) month duration to regain compliance with the CPM schedule.

C. Laboratory and the Contractor will meet for the normal monthly update to determine the effectiveness of the Recovery Schedule and to determine whether the Contractor has regained compliance with the CPM schedule. At the direction of Laboratory, one of the following will occur:

1. If, in the opinion of Laboratory, the Contractor is still behind schedule, the Contractor, in conjunction with Laboratory will prepare another Recovery Schedule at the Contractor's expense, to take effect during the immediate subsequent pay period.
2. If, in the opinion of Laboratory, the Contractor has sufficiently regained the time lost, then compliance with the CPM schedule will be resumed.

- D. Failure of the Contractor to comply with the requirements of Laboratory under this paragraph shall be grounds for determination by Laboratory that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination Laboratory may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with the applicable provisions of the Fixed-Price Construction Contract between UChicago Argonne, LLC and Contractor.

1.9 SCHEDULE REVISIONS

- A. Should the Contractor, after approval of the interim and/or baseline CPM schedules, desire to change Contractor's plan of construction, Contractor shall submit Contractor's requested revisions to Laboratory along with a written statement of the revisions including a description of the logic for rescheduling the work, methods of maintaining adherence to intermediate milestones, specific dates, and the reasons for the revisions. If the requested changes are acceptable to Laboratory, they will be incorporated into the CPM schedule in the next reporting period, unless a contract modification is required. No change to historical (previous period) data is allowed.
- B. When Laboratory orders changes which have the potential to impact the schedule of Dates, a supplemental 'what if' schedule of the new and existing activities directly affected by the change will be prepared by the Contractor and provided with the Contractor's price proposal or extra work tabulation as required to Laboratory for concurrence or revision as Laboratory deems necessary. After the schedule has been approved by Laboratory, it will be incorporated into the CPM baseline schedule by the Contractor. Change Order logic will affect only those activities and performance dates directly concerned. Adjustments in scheduled intermediate completion dates or for the Contract as a whole, will be considered only to the extent that there is insufficient remaining float to absorb these changes. No changes will be made to historical (previous period) data.
- C. Neither the updating or revision of the Contractor's CPM schedule, nor the submission, updating, change or revision of any report or schedule submitted to Laboratory by Contractor under this Section, nor Laboratory's review or nonexistence of any such report or schedule shall have the effect of amending or modifying, in any way, the Schedule of Dates or modifying or limiting in any way Contractor's obligations under this Contract.

1.10 TIME OF COMPLETION

- A. If the Contractor should desire or intend to complete the work earlier than the Schedule of Dates, Laboratory shall not be liable to the Contractor for any costs or other damages should the Contractor be unable to complete the work before his early milestone completion dates or before the Schedule of Dates. Approval by Laboratory of a CPM schedule which indicates completion prior to Schedule of Dates shall be for the convenience of the Contractor and shall not change any of the Contract requirements including but not limited to the Schedule of Dates. All Contract requirements shall be consistent with and applicable only to the completion of the work in accordance with the Schedule of Dates required by the Contract unless Laboratory and Contractor otherwise agree by issuance of the appropriate Change Order.

- B. The updated CPM schedule submitted by Contractor shall not show a completion date later than the Schedule of Dates, subject to any time extensions approved by Laboratory. If Contractor believes Contractor is entitled to an extension to the Schedule of Dates under the Contract Documents; the Contractor shall submit to Laboratory a formal time extension request as required by the Contract and a detailed narrative justifying the time extension requested. The time extension request shall include schedule forecasts that predict the actual Project Completion Date, and any separable portions thereof specified by Laboratory plus a forecast of the actual achievement of any milestones listed in the Schedule of Dates. Laboratory shall have no obligation to consider any time extension request unless the Contractor is in full compliance with the requirements of the Contract Documents. Laboratory shall not be responsible or liable to Contractor for any constructive acceleration due to failure of Laboratory to grant time extensions under the Contract Documents should Contractor fail to substantially comply with the submission requirements and the justification requirements of this Contract for time extension requests. The Contractor's failure to perform in accordance with the CPM schedule shall not be excused, nor be chargeable to Laboratory because Contractor has submitted time extension requests.

1.11 COORDINATION

- A. The Contractor shall coordinate the Contractor's work and that of subcontractors and shall cooperate fully with Laboratory in maintaining orderly progress toward completion of the work as scheduled. Laboratory's decisions regarding priority between the Contractor's work and the work of other trade contractors at the site shall be final and shall not be cause for extra compensation or extension of time, except where extension of time is granted because of a delay for which Contractor is otherwise entitled to an extension of time under the Contract Documents.
- B. Failure of other trade contractors to meet their schedule shall not be justification for an extension of time, except where such failure causes, in the opinion of Laboratory, an unreasonable delay in the Contractor's Work, in which case the provisions of the Fixed-Price Construction Contract between UChicago Argonne, LLC and Contractor regarding extensions of time and extra work shall apply.

1.12 FAILURE TO PERFORM SCHEDULING TASKS

- A. Should the Contractor fail to substantially comply with the provisions of the Contract Documents relating to planning, scheduling, reporting, and execution of the work as called for in the CPM schedule, Laboratory shall have the right, at Laboratory's option, to retain the services of scheduling consultants or experts (including attorneys, if necessary in Laboratory's opinion) to prepare a CPM schedule in accordance with the Contract Documents. This CPM schedule will be used to allow Laboratory to evaluate the program of the Work by Contractor and to determine whether Contractor is substantially complying with the Contract Documents. This CPM schedule will be used to direct such action on the part of the Contractor as permitted by the Contract Documents, and as required to ensure that the Contractor will comply with such schedule. All costs incurred by Laboratory in preparing this CPM schedule shall be charged to the Contractor's account and/or deducted from any monies due to the Contractor. If Contractor fails to substantially comply with the scheduling and execution of the work requirements of the Contract Documents, the Contractor hereby agrees in such instance to comply with such schedules as Laboratory develops or direct activity sequences and durations as Laboratory may reasonably require, without additional cost

to Laboratory (subject only to cost adjustments for such changes in the work as Laboratory may direct), to ensure completion within the Schedule of Dates.

1.13 CONTRACTOR COVENANTS AND GUARANTEES

A. Contractor covenants and guarantees that Contractor will not:

1. Misrepresent to Laboratory its CPM schedule and all of its components or Contractor's actual execution of the work.
2. Utilize schedules materially different from those made available by Contractor to Laboratory, any Subcontractor or separate Contractors for the direction, execution, or coordination of the Work.
3. Prepare schedules, updates, revisions or reports for the work which are not feasible or realistic; or which do not accurately reflect the actual intent or reasonable and actual expectations of Contractor and its Subcontractors.

1.14 PAYMENT FOR SCHEDULING

A. The cost of performing all work incidental to preparing the Project Construction Schedule, including preparation, execution, updates, maintenance, revisions, and adjustments shall be included in the Bid Proposal as overhead distributed to appropriate bid items and CPM schedule activities.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Submittal procedures;
 2. Schedules of submittals required;
 3. Submittal review procedures;
 4. Contractor responsibilities;
 5. Resubmittal requirements;
 6. Contract closeout submittals;
 7.
 - a. Furnish all labor, materials, tools, equipment, and services for furnishing, processing, delivery, reproduction and other functions for scheduling and handling of submittals as indicated, in accord with Contract Documents.
 - b. Completely coordinate with work of all other trades.
 - c. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for completion of work under this Section.
 8. See Specification Divisions 0 and 1 for additional requirements; and
 9. See technical specification sections for specific submittal requirements.

1.2 SUBMITTAL PROCEDURES

- A. Accompany submittals with a completed Submittal Transmittal Form.
- B. Make four (4) submittal copies unless otherwise specified.
- C. Send submittals to Laboratory and Laboratory's designated representative for review, according to the Laboratory approved procedures established for implementation of the automated, web-based Project Management and Control System (PMCS).
- D. Failure to comply may result in return of submittal without review.

- E. The Contractor is responsible for review of all submittals before transmitting to Laboratory or Laboratory's Designated Representative.

1.3 FILING CONSTRUCTION CONTRACT

- A. NOT USED.

1.4 CONSTRUCTION PROGRESS SCHEDULE

- A. Submit a schedule in a form which is acceptable to Laboratory and Laboratory's designated representative in accordance with Specification Section 01 31 00.

1.5 SUBMITTAL SCHEDULE

- A. Submit a submittal schedule to Laboratory or Laboratory's Designated Representative for review and approval.

- 1. Include all shop drawings, data, samples and other items required to be submitted.

- B. Partial payment requests will not be processed until the itemized schedule is received and approved.

1.6 PRODUCT LIST

- A. Within fourteen (14) days after Notice To Proceed submit four (4) copies of complete list of products, equipment, materials and Material Suppliers proposed for use to Laboratory or Laboratory's Designated Representative.

- B. Tabulate by specification sections.

- C. Only items which have been specified or approved by Addenda or Agreement may be used.

- D. No partial payment requests will be processed until this data and other submissions required by Contract Documents are received.

- E. For products specified under reference standards or approved equal products, each submittal shall include information according to Specification Section 01 63 00 and 01 63 20.

- F. Provide names, addresses, and telephone numbers of material suppliers, indicating by Specification Section Number Work to be performed by each. Identify materials and equipment by brand and/or model including:

- 1. Items proposed in compliance with specified reference standards;
- 2. Items proposed in compliance with descriptive specifications where a specific proprietary product is not indicated; and

3. Items proposed in compliance with proprietary specifications.

1.7 PROGRESS REPORTS

- A. Submit progress report at end of each month include the following information (specific day due to be established by Laboratory):
 1. Report number (in chronological order by week starting with No. 1 on the first report);
 2. Date on which report is made;
 3. Days during which Work was prohibited or delayed due to weather conditions;
 4. Trades on Site during period with a brief summary of Work accomplished by each;
 5. Major material items delivered to Site during period;
 6. Brief statement of progress of Work related to overall construction schedule;
 7. Description of unexpected delays which occurred or delays that are anticipated. Indicate steps taken to offset delay;
 8. Log of visitors to the Project by date of visit including Architect's and Laboratory 's personnel;
 9. Description of safety problems, if any, including corrective actions taken;
 9. Description/Log of Injuries, Including First-aid Cases; and
 9. Name and title of person preparing report.

1.8 CONTRACTOR RESPONSIBILITIES

- A. The Contractor is responsible for review of all submittals before transmitting to Laboratory or Laboratory's Designated Representative.
- B. Determine and verify:
 1. Field measurements.
 2. Field construction criteria.
 3. Conformance with Contract Documents.
 4. Coordination with other work.
- C. Coordinate each submittal with requirements of the Work, Construction Schedule, and Contract Documents.

- D. Notify Laboratory or Laboratory's Designated Representative in writing, at time of submittal, of deviations in submittals from requirements of the Contract Documents.
- E. Do not begin fabrication or Work until appropriate submittal approval.
- F. Contractor is responsible for delays caused by improper submittal procedures or incomplete submittals.
- G. After Contractor has completed review of returned submittal from Laboratory or Laboratory's Designated Representative, distribute copies of submittals to subcontractors and to other concerned parties. See Specification Section 01 72 00.
- H. Each submittal shall bear the Contractor's stamp of approval, and the Contractor shall notify Laboratory or Laboratory's Designated Representative in writing of deviations in submittals from requirements of the Contract Documents.

1.9 RESUBMITTAL REQUIREMENTS

- A. Make corrections or changes in submittals required by Architect or their consultants and resubmit when Architect's stamp requires submittal.
- B. Contractor is responsible for delays caused by resubmittal process.

1.10 SPECIAL SUBMITTALS

- A. Test Reports: When required, submit test reports and data in conformance with Contract Documents (See Specification Section 01 40 00 and Division 01 Specifications).
- B. Contract Closeout Submittals: See Specification Section 01 70 00 for Contract Closeout Submittals.

1.11 SUBMITTALS - SHOP DRAWINGS

- A. Identify drawings with manufacturer, item, use, type, project designation, specification section or drawing detail reference, and other pertinent data as required by the Contract Documents.
- B. Submit one (1) reproducible transparency and four (4) prints of each drawing to Laboratory or Laboratory's Designated Representative.
 - 1. Submit in mailing tube.
 - 2. Do not fold.
 - 3. PRINTS ARE NOT ACCEPTABLE in lieu of reproducible transparency.

4. Submit drawings maximum size 36 x 42 IN., unless size of items depicted makes such small size impractical.
 5. Allow clear space, approximately 40 SQ IN., for stamping on right hand side.
- C. Submit standard items like equipment brochures, cuts of fixtures, or standard catalog items in four (4) copies.
1. Mark copies to clearly indicate exact item or model and all proposed options.
 2. Include scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, controls and other pertinent data.
- D. Submit one (1) copy of each approved drawing for final record (reference Section 01 70 00).
- E. Include one (1) copy of each final submittal in each copy of the O & M Manuals.
- F. Shop drawing plans may be prepared in CADD and transmitted to Laboratory or Laboratory's Designated Representative, at Substantial Completion.
- G. Reference Section 01 04 00 for additional requirements related to coordination shop drawings.
- H. At Contractor's option, a Shop Drawing submittal, in compliance with all other requirements of this section, may be scanned to pdf file format and submitted via e-mail.

1.12 SUBMITTALS - SAMPLES

- A. Identify samples with manufacturer's name, item, use, type, project designation, specification section or drawing detail reference, color, range, texture, finish and other pertinent data as required by General Contractor's Manual.
- B. Submit samples to Laboratory or Laboratory's Designated Representative or construction site if required.
1. Include brochures, shop drawings, and installation instructions with transmittal.
 2. Submit transmittal for site-built samples to address indicated.
- C. Architect may, at its option, retain samples for comparison purposes until completion of work.
1. Samples will be returned or may be used in the work unless technical section specifically indicates otherwise.
 2. Remove samples when directed.

3. Pay all costs of furnishing or constructing, and removing samples.

1.13 CONTRACTOR ACTION: SHOP DRAWINGS, PROJECT DATA AND SAMPLES

- A. Contractor responsible for making all submissions.
 1. Submit according to the Laboratory approved procedures established for implementation of the automated, web-based PMCS.
 2. Transmit all items with transmittal form per the PMCS.
 3. Identify each transmittal using the six digit specification number with a dash and an added number, i.e., metal handrails might be numbered 05 50 00-1. If returned for resubmission, second submission would be 05 50 00-1A.
- B. Review all items prior to submission to Laboratory or Laboratory's Designated Representative and stamp indicating Contractor's:
 1. Verification of all field dimensions and quantities.
 2. Verification of field construction criteria, materials, catalog numbers and similar data.
 3. Review and coordination of submittal data with requirements of the work and the Contract Documents.
- C. INDICATE any item, component, material or portion of work which deviates from Contract Documents.
- D. Make submittals sufficiently in advance of date required to allow Architect reasonable time for review, and resubmission if necessary.
 1. ITEMS SUBMITTED WITHOUT CONTRACTOR'S REVIEW STAMP WILL BE REJECTED.
 2. Items not submitted in accord with provisions of this section will be returned, without action, for resubmission.
 3. Submissions on items not approved for use by specifications or addenda will be rejected.
- E. Reproduce and distribute submittals receiving "furnish as submitted" and "furnish as noted" stamp.
- F. Revise and resubmit items stamped, "revise and resubmit", "rejected", or similar instruction.

1.14 ARCHITECT REVIEW

- A. Review is general and does not:
 - 1. Permit departure from Contract Documents;
 - 2. Relieve Contractor from responsibility for errors in detail, dimensions or related items;
 - 3. Approve departure from previous instruction or details;
 - 4. Relieve Contractor of responsibility to provide, all components, wiring, etc. required to make item operational or usable; or
 - 5. Imply acceptance of items for which no data is submitted.
- B. Reviewed samples submitted or constructed constitute criterion for judging completed work. Finish work or items not equal to samples will be rejected.
- C. Start of work which requires submittals, prior to return of submittals with Architects/Engineer's stamp indicating review is at Contractor's risk.

1.15 SUBMITTALS – LEED INFORMATION

- A. LEED Information submittals are required as called for by specification section Submittal paragraph.
- B. Unless otherwise agreed to by Architect, submit to Architect's for records one (1) original, or high quality high contrast copy of submittal suitable for reproduction, unless quantity is indicated elsewhere, submittal. Submit quantity indicated in specifications sections to Laboratory.
 - 1. Architect is not required to return submittal.
 - 2. Include pertinent data.
 - 3. Information shall be 215 x 280 mm or 215 x 355 mm 8-1/2" x 11" or 8-1/2" x 14" maximum.
 - 4. Do not fold. Submit in envelope large enough for submitted items.
- C. LEED Information submittals are required as called for by specification section submittal paragraph.
 - 1. Identify LEED submittals with:
 - a. Manufacturer's name, item, use, type,
 - b. Specification Section or drawing detail reference,
 - c. Data required for LEED Prerequisite or Credit and
 - d. Other pertinent data.

- D. Unless otherwise agreed to by Architect, submit one (1) original or high quality, high contrast copy, suitable for reproduction of submittal, unless quantity is indicated elsewhere.
1. Include pertinent data.
 2. Information shall be 215 x 280 mm or 215 x 355 mm 8-1/2" x 11" or 8-1/2" x 14" maximum.
 3. Do not fold. Submit in envelope large enough for submitted items.
- E. LEED Action Plans:
1. As indicated in Section 01 35 36 - LEED Requirements, submit LEED Action Plan no more than 30 days after execution of the contract
 2. At close of Project, provide statement indicating total cost for building materials used for Project. Include statement indicating total cost of mechanical and electrical components.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01 35 10
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Each trade shall perform all cutting, patching, removal and re-installation or replacement of existing constructions specified and required for installation of that trade's Work.
- B. Do not endanger any Work by cutting or altering Work or any part of it.
- C. Do not cut or alter Work of another Contractor without written consent of Laboratory's designated Project Manager.
- D. Coordinate work of trades and schedule elements of alterations and renovation work by procedures and methods to expedite completion of the Work.
- E. Include in the Contract removal and reinstallation or replacement of reasonably observable existing construction required by the Work of the Project.
- F. Conform to the requirements of authorities having jurisdiction, including lead, asbestos, PCB's, environmental and health hazards, air, water and ground quality and legal disposal of waste.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. For replacement of Work removed:
 - 1. Comply with Specifications for type of Work to be done.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect existing conditions of Work, including elements subject to movement or damage.
- B. Inspect the reasonably observable existing construction of the facility for removal and re-installation or replacement of existing construction required by the Work of the Project and for patching of existing construction of the facility required by the Work of the Project.

- C. After uncovering Work, inspect conditions affecting installation of new products or performance of the Work.

3.02 ASBESTOS CONTAINING MATERIALS

- A. Exercise extreme care when working around known, indicated and/or suspected asbestos containing materials such as, but not limited to, spray-on fireproofing, insulation or sound absorbing materials; duct coverings, pipe coverings, etc.

3.03 EXISTING SPECIAL SYSTEMS

- A. Inspect the facility for the presence of special systems that must be maintained operational during alterations in the presence of the Laboratory. Such systems include steam and condensate systems, scientific process systems, electrical equipment, fire and smoke detection, alarm, and communication systems.
- B. Develop a strategy with the Laboratory to maintain such systems operational during alterations including temporary re-working, unavoidable down time, acceptable discontinuing of service intervals and contingencies for notification of involved agencies.
- C. Instruct every Subcontractor as to the procedures to be followed and supervise the process to ensure implementation.
- D. Restore such systems and extend them into the altered.
- E. Include all services and materials in the Contract Sum.

3.04 PREPARATION

- A. Provide shoring, bracing and support as required to maintain structural integrity of Project.
- B. Provide protection for other portions of Project.
- C. Provide protection from elements.

3.05 PERFORMANCE

- A. Execute Work by methods which will prevent damage to other Work, and will provide proper surfaces to receive installation of repairs and new Work.
- B. Restore Work which has been cut or removed, install new products to provide completed Work in accord with requirements of Contract Documents.
- C. Where existing construction is removed, patch and finish exposed surface or construction to match adjacent existing.

- D. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance.
- E. Provide workmen skilled in the type of patching required in each case. Patch with materials as specified, where not specified Contractor to match existing.

3.06 WORK IN EXISTING BUILDINGS

- A. Cutting, chases and patching required by Contractor shall be by Contractor, except where otherwise shown on the Contract Documents.
- B. Limit cutting to the minimum required.
- C. Core drill and cut to line.
- D. Limit noisy operations. Coordinate with Laboratory.
- E. Coordinate route to exit of demolished materials and maintain such routes clean and dust free.
- F. Provide secure, dust-tight barricades where required to separate work area from used areas and to prevent entry by unauthorized parties.
- G. Where existing painted surfaces are to be disturbed by alteration procedures, conform to the laboratory guideline directions, and, as a minimum, following unless the Contractor can demonstrate that such paint does not contain lead:
 - 1. Minimize dust and flaking by careful cutting and removal and use of dust extraction equipment.
 - 2. Provide local enclosure to limit area of dust scattering.
 - 3. Provide disposable floor and ground protection to catch dust and flakes.
 - 4. After cutting and removal, HEPA vacuum all surfaces within enclosure or within the area.
 - 5. Wipe all horizontal surfaces.
 - 6. Remove temporary protection and coverings in a manner to enclose dust and debris within disposable covering and dispose of legally.

END OF SECTION

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ANL Document No. J241-101-W-T015 Revision 1, Issued for Proposal – 3/7/11

01 35 10-4

Issued for Construction - 6/30/11

SECTION 01 35 36

LEED REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This is an overview of the special LEED requirements of this project. Work includes environmental, sustainable, and “green” building practice requirements related to energy conservation and efficiency, indoor air quality, and resource efficiency. It is the goal of this project, as much as is feasible and practical, to construct a “green” building that meets the US Green Building Council’s LEED™ Green Building Rating System Version as follows:
1. LEED-NC Version 2.2
 2. Rating: Gold.

1.2 LEED REQUIREMENTS-GENERAL

- A. General: Laboratory has established with design team specific LEED requirements for design and construction of Project; Contractor, subcontractors, suppliers, and manufacturers (i.e., construction team) are encouraged to participate where possible to realize Laboratory’s LEED goals.
1. Intent is for LEED goals to be achieved in manner that ultimately provides safe and healthy environment for building occupants with minimal negative impact on local, regional and global environment.
 2. Contract Documents are not intended to limit alternative means of achieving LEED requirements. Suggestions from construction team during project meetings for implementing goals are encouraged.

1.3 CONTRACTOR RESPONSIBILITIES

- A. LEED Action Plan
1. LEED Action Plan shall be submitted within 30 days after notice to proceed. The plan, when completed, shall provide a detailed description of all activities that relate to accomplishing project LEED requirements, including construction practices, procurement practices, and proposed submittals and documentation for each LEED credit for which the contractor is responsible. Plan shall also include the following:
 - a. Name of individual[s] responsible for ensuring those credits and/or prerequisites are earned and responsible for assembling documentation.
- B. LEED Documentation Notebook
1. The Contractor shall prepare a comprehensive notebook documenting compliance for each LEED credit for those construction credits for which they are responsible. LEED Documentation Notebook shall be formatted to match LEED numbering system for each credit and prerequisite. The original, or an electronic version on CD of the notebook shall be submitted at project closeout.
 2. Notebook shall include the LEED Credit Checklist as furnished at the end of this document (or other approved checklist), applicable product data for material selection, final calculations, certifications for construction practices, procurement data, cumulative calculations and other items as identified in the approved LEED Action Plan. Notebook must contain all required data to support full compliance with the indicated LEED construction credits.

3. Some LEED credits are inherent in the design provided and require no further submittal or documentation. For these credits, the Contractor shall notify the Architect in advance of selection of any specified material or use of any permissible construction methods that may result in a deviation from the LEED designer intent. Some LEED credits involve material selection and are generally identified within the technical sections with the notation "LEED," though not specifically identified in all occurrences. Some LEED credits are dependent on construction practices. In all cases where a material, product, or execution requirement is identified by "LEED" in the contract documents, additional data or certificates shall be submitted with the individual component or process validating the material or component to the respective LEED credit item.
- C. LEED Project Management and Coordination: Prior to the pre-construction meeting, Contractor shall identify and assign one person on Contractor's staff to be the LEED Project Manager who shall be responsible for LEED issues compliance and coordination.
1. Experience: Similar responsibilities and successful performance for previous sustainable building construction project(s).
 2. Responsibilities: Carefully review Contract Documents for LEED issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to LEED issues; and oversee Project LEED Goals.
 - a. Assemble and retain approved LEED Submittals, tabulation charts and other records to document progress toward meeting LEED requirements.
 - b. Provide records in secure jobsite location, available for review by Architect or Laboratory.
 - c. Provide Action Plans, Progress Reports and final documentation according to specified requirements and schedule.
 - d. Assist Architect and/or Laboratory in preparing submission to the GBCI.

1.4 LEED CALCULATIONS

- A. LEED credits as identified in Table 1 shall be incorporated and documented as required by the Contract documents and in full compliance with the LEED Reference Guide. LEED credits not identified elsewhere in the Contract documents and those requiring further instruction are specified below. Refer to the LEED Reference Guide for further definitions and requirements.
- B. Sustainable Sites Credits:
1. LEED Credit SS p, Construction Activity Pollution Prevention:
 - a. Comply with 2001 EPA Construction General Permit or local standards if more stringent.
- C. Material and Resources Credits:
1. LEED Credit MR 2.1 and 2.2, Construction Waste Management:
 - a. Comply with Division 1 Section 01 74 19 - Construction Waste Management.
 2. LEED Credit MR 4.1 and MR 4.2, Recycled Content:
 - a. Contractor shall document materials to indicate that the sum of post-consumer recycled content value plus one-half of post-industrial recycled content value constitutes at least 20 percent of the total materials cost for the project. Recycled content materials are specified so that the sum of post-consumer recycled content value plus one-half of post-industrial recycled content value constitutes at least 20 percent of the total materials cost for the project.
 - 1) Calculations
 - a) LEED Letter Template forms shall be used for tracking and documentation. Recycled content value of project materials shall be determined by the method described in the LEED Reference Guide.
 - 2) Substitutions

- a) In the case of conflict between this requirement and individual technical section requirements, Contractor may submit for approval proposed alternative products or systems that provide equivalent performance and appearance and have greater contribution to project recycled content requirements. All such proposed substitutions shall be submitted with the LEED Implementation Plan accompanied by product data that demonstrates equivalence.
 - 3. LEED Credit MR 5.1 and MR 5.2 Regional Materials:
 - a. Contractor shall document materials to indicate that a minimum of 20 percent (by dollar value) of materials and products for the project are extracted, harvested, or recovered, as well as manufactured, regionally within a 500 mile radius of the project site.
 - 1) Calculations
 - a) LEED Letter Template forms shall be used for tracking and documentation. Amount of regional project materials shall be determined by the method described in the LEED Reference Guide.
 - 4. LEED Credit MR 6, Rapidly Renewable Materials:
 - a. Contractor shall document that a minimum of 2.5 percent (by dollar value) of materials and products for the project shall be rapidly renewable. Rapidly renewable materials are made from plants with a 10-year or shorter harvest cycle.
 - b. Contractor shall track cumulative calculations for this credit.
 - 5. LEED Credit MR 7, Certified Wood:
 - a. Contractor shall document materials to indicate a minimum of 50 percent (by dollar value) of permanently installed wood-based materials and products for the project are certified in accordance with FSC STD 01 001.
 - 1) Calculations:
 - a) LEED Letter Template shall be used for tracking and documentation. Amount of FSC-certified project materials shall be determined by the method described in the LEED Reference Guide.
- D. Indoor Environmental Quality Credits:
 - 1. LEED Credit EQ 3.1, Construction IAQ Management Plan: During Construction:
 - a. Comply with Division 01 section 01 81 21 - Indoor Air Quality Management (IAQ) During Construction.
 - 2. LEED Credit EQ 3.2, Construction IAQ Management Plan – Before Occupancy:
 - a. Comply with Division 01 section 01 81 22 - Construction IAQ Management Plan – Before Occupancy.
 - 3. LEED Credit EQ 4.1, Low-Emitting Materials – Adhesives and Sealants:
 - a. Comply with VOC requirements for adhesives and sealants specified in Divisions 03 – 12.
 - b. Where VOC requirements are not indicated comply with South Coast Air Quality Management District Rule #1168.
 - 4. LEED Credit EQ 4.2, Low-Emitting Materials – Paints and Coatings:
 - a. Comply with VOC requirements for paints and coatings specified in Divisions 03 – 12.
 - b. Where VOC requirements are not indicated comply with the following standards:
 - 1) Green Seal Standard GS-11.
 - 2) Green Seal Standard GS-03.
 - 3) South Coast Air Quality Management District Rule #1113.
 - 5. LEED Credit EQ 4.3, Low-Emitting Materials – Flooring Systems:
 - a. Comply VOC requirements for flooring systems as specified in Division 03 – 12.
 - b. Where VOC requirements are not indicated comply with the following standards:
 - 1) Carpet and Rug Institute Green Label Plus program.
 - 2) Carpet and Rug Institute Green Label program.
 - 3) Resilient Floor Covering Institute FloorScore program.
 - 4) South Coast Air Quality Management District Rule #1113.
 - 5) South Coast Air Quality Management District Rule #1168.
 - 6. LEED Credit EQ 4.4, Low-Emitting Materials – Composite Wood and Agrifiber Products:

- a. Comply material requirements for composite wood products as specified in Division 03 - 12.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 COORDINATION MEETINGS

- A. There will be a minimum of three onsite coordination meetings.
 - 1. The first will be a preconstruction meeting to review the LEED Implementation Plan.
 - 2. The second will be a pre-closeout meeting to review LEED Documentation Notebook for completeness and identify any outstanding issues relating to final score and documentation requirements.
 - 3. The third is a closeout meeting to review the final LEED Documentation Notebook. All meetings shall be attended by Contractor's designated individual responsible for LEED documentation, Government representative and Installation representative.
 - 4. At closeout meeting a final score for the project will be determined based on review of project performance and documentation. Contractor shall make a set of contract drawings and specifications available for review at each meeting as well as an updated LEED Documentation Notebook.

3.2 CHECKLISTS

- A. LEED credits as identified in Table 1 below are contract requirements and shall be incorporated in full compliance with the LEED Reference Guide.

TABLE 1

LEED NC-2.2 Credit Checklist

SUSTAINABLE SITES

SS	Prerequisite 1:	Construction Activity Pollution Prevention (C)
SS	Credit 1:	Site Selection (D)
SS	Credit 4.1:	Alternative Transportation: Public Transportation Access (D)
SS	Credit 4.2:	Alternative Transportation: Bicycle Storage & Changing Rooms (D)
SS	Credit 4.3:	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles (D)
SS	Credit 4.4:	Alternative Transportation: Parking Capacity (D)
SS	Credit 5.1:	Site Development: Protect or Restore Habitat (C)
SS	Credit 5.2:	Site Development: Maximize Open Space (D)
SS	Credit 6.1:	Stormwater Design: Quantity Control (D)
SS	Credit 6.2:	Stormwater Design: Quality Control (D)
SS	Credit 7.1:	Heat Island Effect: Non-Roof (C)
SS	Credit 7.2:	Heat Island Effect: Roof (D)
SS	Credit 8:	Light Pollution Reduction (D)

WATER EFFICIENCY

WE	Credit 1.1:	Water Efficient Landscaping: Reduce by 50% (D)
WE	Credit 1.2:	Water Efficient Landscaping: No Potable Water Use or No Irrigation (D)
WE	Credit 2:	Innovative Wastewater Technologies (D)
WE	Credit 3.1:	Water Use Reduction: 20% (D)
WE	Credit 3.2:	Water Use Reduction: 30% (D)

ENERGY & ATMOSPHERE

EA	Prerequisite1:	Fundamental Commissioning of the Building Energy Systems (C)
EA	Prerequisite2:	Minimum Energy Performance (D)
EA	Prerequisite3:	Fundamental Refrigerant Management (D)
EA	Credit 1:	Optimize Energy Performance (D)
		Improve by 10% for New Buildings or 3.5% for Existing Building Renovations

Improve by 14% for New Buildings or 7% for Existing Building Renovations
 Improve by 17.5% for New Buildings or 10.5 for Existing Building Renovations
 Improve by 21% for New Buildings or 14% for Existing Building Renovations
 Improve by 24.5% for New Buildings or 17.5% for Existing Building Renovations
 Improve by 28% for New Buildings or 21% for Existing Building Renovations
 Improve by 31.5% for New Buildings or 24.5% for Existing Building Renovations
 Improve by 35% for New Buildings or 28% for Existing Building Renovations
 Improve by 38.5% for New Buildings or 31.5% for Existing Building Renovations
 Improve by 42% for New Buildings or 35% for Existing Building Renovations

- EA Credit 2: On-Site Renewable Energy (D)
- EA Credit 3: Enhanced Commissioning (C)
- EA Credit 4: Enhanced Refrigerant Management (D)
- EA Credit 5: Measurement & Verification (C)
- EA Credit 6: Green Power (C)

MATERIALS & RESOURCES

- MR Prerequisite 1: Storage & Collection of Recyclables (D)
- MR Credit 2.1: Construction Waste Management: Divert 50% From Disposal (C)
- MR Credit 2.2: Construction Waste Management: Divert 75% From Disposal (C)
- MR Credit 4.1: Recycled Content: 10% (post-consumer + 1/2 pre-consumer) (C)
- MR Credit 4.2: Recycled Content: 20% (post-consumer + 1/2 pre-consumer) (C)
- MR Credit 5.1: Regional Materials: 10% Extracted, Processed & Manufactured Regionally (C)
- MR Credit 5.2: Regional Materials: 20% Extracted, Processed & Manufactured Regionally (C)
- MR Credit 6: Rapidly Renewable Materials (C)
- MR Credit 7: Certified Wood (C)

INDOOR ENVIRONMENTAL QUALITY

- EQ Prerequisite 1: Minimum IAQ Performance (D)
- EQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control (D)
- EQ Credit 1: Outdoor Air Delivery Monitoring (D)
- EQ Credit 3.1: Construction IAQ Management Plan: During Construction (C)
- EQ Credit 3.2: Construction IAQ Management Plan: Before Occupancy (C)
- EQ Credit 4.1: Low-Emitting Materials: Adhesives & Sealants (C)
- EQ Credit 4.2: Low-Emitting Materials: Paints & Coatings (C)
- EQ Credit 4.3: Low-Emitting Materials: Carpet Systems (C)
- EQ Credit 4.4: Low-Emitting Materials: Composite Wood & Agrifiber Products (C)
- EQ Credit 5: Indoor Chemical & Pollutant Source Control (D)
- EQ Credit 6.1: Controllability of Systems: Lighting (D)
- EQ Credit 6.2: Controllability of Systems: Thermal Comfort (D)
- EQ Credit 7.1: Thermal Comfort: Design (D)
- EQ Credit 7.2: Thermal Comfort: Verification (D)
- EQ Credit 8.1: Daylight & Views: Daylight 75% of Spaces (D)
- EQ Credit 8.2: Daylight & Views: Views for 90% of Spaces (D)

INNOVATION & DESIGN PROCESS

- ID Credit 1.1: Innovation in Design
- ID Credit 1.2: Innovation in Design
- ID Credit 1.3: Innovation in Design
- ID Credit 1.4: Innovation in Design
- ID Credit 2: LEED Accredited Professional

Notes: (D) signifies Design credit

END OF SECTION

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Issued for Construction - 6/30/11

SECTION 01 40 00
QUALITY CONTROL

1.00 GENERAL

1.01 DESCRIPTION

- A. This section covers general requirements for quality control of the work, including testing and inspection procedures.
- B. Related work:
 - 1. Specific test procedures to be performed in accordance with this section are specified in the applicable sections of Divisions 2 through to 28 of these Specifications.
 - 2. Testing of mechanical and electrical work: Division 20 thru 28.
 - 3. Testing of conveying systems: Division 14.
 - 4. Testing of glazed assemblies: Division 8.
 - 5. Roofing and waterproofing tests and inspections: Division 7.
 - 6. Testing of materials specified to be tested by other agencies under other sections.
 - 7. Commissioning: Division 01
 - 8. Testing of HVAC Controls and Instrumentation: Division 25
- C. Definitions and qualifications:
 - 1. Testing laboratory or agency: Licensed testing laboratory or agency certified as meeting the requirements of ASTM as applicable to the tests and inspections performed, approved by Laboratory, and referred to hereafter as the Testing Laboratory.
 - 2. Soils Engineer: Registered professional geotechnical engineer employed and paid by Laboratory.
 - 3. Laboratory's Inspector: Lead Inspector or member of Inspection Team (hereinafter referred to as the Inspector).
 - 4. Disqualified material: Any material shipped or delivered to the site by the Contractor from the source of supply prior to having satisfactorily passed the

required test and inspection, or prior to the receipt of a notice from Laboratory that such test and inspection will not be required, shall not be incorporated in the work.

1.02 CONTRACTOR'S QUALITY CONTROL SYSTEM

- A. Contractor shall establish a quality control system to perform sufficient inspections and tests of all items of Work, including that of subcontractors, to ensure conformance to the Contract Documents for materials, workmanship, construction, finish, functional performance and identification. Contractor shall submit a comprehensive Quality Control & Quality Assurance program to Laboratory or Laboratory's Designated Representative for reference fourteen (14) days after Award of Contract.
- B. Contractor's quality control system is the means by which Contractor assures that the Work complies with the requirements of the Contract Documents. Controls shall be adequate to cover all construction operations.

1.03 GENERAL QUALITY CONTROL REQUIREMENTS

- A. Materials to be furnished under the Contract are subject to test and inspection for compliance with Contract Documents.
- B. Testing required by the Contract Documents shall be performed under supervision and control of an Illinois licensed professional engineer employed by testing laboratory.
- C. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned in accordance with their manufacturer's latest published instructions, unless more restrictive or stringent requirements are specified in the Specifications.
 - 1. If product manufacturers instructions are in conflict with the Contract Documents notify Laboratory or Laboratory's Designated Representative for clarification before proceeding. Keep a copy of the various product manufacturers' instructions applicable to the Work at the Project site.
- D. Certificates:
 - 1. Where specified, deliver to Laboratory or Laboratory's Designated Representative two (2) signed certificates from suppliers of materials, equipment and manufactured items stating that such materials and manufactured items meet or exceed the standards specified.
 - 2. In lieu of such certification, the Contractor may submit reports of current tests made and attested by a reputable and recognized testing laboratory.

- E. The Inspectors will reject non-conforming work and issue Non-Compliance notices. The Testing Laboratory and Soils Engineer are not authorized to accept or reject any work, to modify any Contract Document requirement, to advise or instruct the Contractor or Contractor's employees as to prosecution of the Work. Inspections will not relieve the Contractor of the obligation to fulfill all requirements of the Contract Documents.

1.04 COORDINATION OF TESTS AND INSPECTIONS

- A. Contractor shall schedule, initiate and coordinate tests and inspections required by the Contract Documents and authorities having jurisdiction of the work.
- B. Contractor shall provide the Testing Laboratory sufficient advance notice of the manufacture of materials to be supplied which, by requirements of the Contract Documents, must be tested at the source of supply so that the laboratory may arrange for testing. Contractor shall proceed in the same manner for tests to be performed at the site.

1.05 TEST SAMPLES AND PROCEDURES

- A. Test samples: Contractor shall furnish samples of materials to be tested at no extra cost to Laboratory. Test samples will be selected by the Testing Laboratory and not by the Contractor.
- B. Test procedures:
 - 1. Testing Laboratory shall perform tests according to method(s) of test specified in these Specifications.
 - 2. If no procedure or test method is specified, testing shall conform to material specification referenced unless otherwise directed by Laboratory or Laboratory's Designated Representative.
 - 3. The Testing Laboratory shall tag, seal, label, record or otherwise suitably identify the materials for testing. No such materials shall be used in the work until the test reports are submitted and approved, excepting only the materials specified to be placed or installed prior to testing.
- C. Re-testing: Applicable tests shall be repeated at specified intervals, whenever the source of supply is changed, or whenever the characteristics of the materials change or vary during the course of construction.

1.06 TEST COSTS

- A. Contractor shall pay for inspections and tests, except as otherwise specified.

- B. Contractor shall arrange and pay for materials qualification and conformance tests, and concrete and masonry mix designs, all performed by a testing laboratory approved by Laboratory. When not specified, Laboratory may request that materials be tested. If materials are in compliance with the Contract Documents, then Laboratory will pay for the tests; if the materials are not, then the cost of these requested tests shall be paid by the Contractor or deducted from payments due to Contractor.
- C. Contractor shall reimburse Laboratory all or any part, as Laboratory may deem just and proper, of the test and inspection costs incurred by Laboratory due to the following:
1. Re-testing costs caused by failure of materials to pass additional tests.
 2. Contractor's failure to complete the work within the Schedule of Dates.
 3. Claims between separate trade contractors.
 4. Covering of work before the required inspections or tests are performed.
 5. Additional inspections required for Contractor's correction of defective work.
 6. Overtime costs for acceleration of work done for Contractor's convenience.

1.07 TEST REPORTS

- A. Furnish copies of each test result, signed and certified by the Testing Laboratory supervising engineer as follows:

Copies

Laboratory	1
Architect	1
Structural Engineer (structural tests only)	1
Contractor	2
CM	3

- B. Reports shall include the following:

- Date issued and date of test.
- Project title.
- Testing laboratory name and address.
- Name and signature of Inspector.
- Date of inspection and sampling.

- Record of temperature and weather.
- Identification of product and Specification Section where test is specified.
- Location on Project.
- Type of inspection and test.
- Observation regarding compliance with Contract Documents.

C. All test reports shall be distributed directly from the Testing Laboratory to the above referenced parties and not via the Contractor.

1.08 CONTINUOUS AND SPECIAL INSPECTIONS

- A. Project and concrete/masonry inspection will be performed by Inspectors employed by Laboratory as required by the Contract Documents and the Building Code.
- B. Special inspections will be performed by inspectors employed by the Contractor as required by the Contract Documents and the Building Code.
- C. Work requiring such inspection that is performed or constructed in the absence of the Inspector will be considered defective and may be subject to rejection.
- D. Contractor shall give written notice to Laboratory or Laboratory's Designated Representative at least two (2) working days in advance of the performance of any work requiring inspection and state the probable duration of the required inspection. The inspection of material or equipment at the factory or shop will not constitute an acceptance.

1.09 APPROVAL REQUIRED BY OTHERS

- A. If laws, ordinances, rules, regulations or orders of public agency having jurisdiction require work to be inspected, tested or approved by some authority other than as required by the Contract Documents, the Contractor shall give required notices and make arrangements, deliver to Laboratory or Laboratory's Designated Representative the certificates of inspection, test, or approval of such public agency, and pay costs therefor unless otherwise provided in the Contract Documents.

1.10 CONTRACTOR'S ASSISTANCE

- A. Contractor shall provide access, facilities and labor necessary for duties to be performed at the site by Testing Laboratory and Inspector, including furnishing ladders, hoist, lighting, water supply and like materials and equipment.
- B. Contractor shall provide and maintain, for the sole use of the Testing Laboratory, adequate facilities for the safe storage and proper curing of concrete test cylinders on the Project site as required.

- C. Contractor shall make arrangements with the Testing Laboratory and pay for additional samples and tests made for the Contractor's convenience or for retesting.
- D. The services performed by Laboratory's Testing Laboratory shall in no way relieve the Contractor of responsibility for performing all work in accordance with Contract requirements.

1.11 VERIFICATION OF CONDITIONS

- A. Prior to installation of any product, Contractor shall inspect existing conditions to receive materials to be installed and arrange for correction of defects in the existing workmanship, material or conditions that may adversely affect work to be installed.
- B. Installation of materials constitutes acceptance of existing conditions as being in proper condition to receive the materials to be applied and waiver of claim that existing conditions are defective as pertains to warranty requirements, excluding unascertainable or concealed conditions.
- C. Where the Specifications require a material to be installed under the supervision or inspection of the material manufacturer or manufacturer's representative, manufacturer or representative shall also inspect the work in place and issue a letter of approval to the Department.

1.12 RECORDS

- A. Contractor shall maintain correct records on an appropriate form for all inspections and tests performed, instructions received from Laboratory or Laboratory's Designated Representative or testing agency, and actions taken as a result of those instructions.
- B. Records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken.
- C. Contractor shall document inspections and tests as required by each Section of the Specifications.
- D. Contractor shall provide and maintain a directory of those persons responsible for ensuring Quality Control for each trade.
- E. Contractor shall use "Contractor Inspection Request" Form as provided by Laboratory or Laboratory's Designated Representative.

END OF SECTION

SECTION 01 42 11
ABBREVIATIONS - ORGANIZATIONS AND STANDARDS

AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
ADC	Air Diffusion Council
AGA	American Gas Association
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
APA	APA – The Engineered Wood Association
ARI	Air Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BAAQM	Bay Area Air Quality Management District
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association
BOCA	Building Officials and Code Administration International, Inc.
CAC	California Administrative Code
CP	Comprehensive Procurement Guide (EPA)
CRA	California Redwood Association
CRREL	Cold Region Research Engineering Lab
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard (U.S. Department of Comm.)
CSI	Construction Specifications Institute
CTI	Cooling Tower Institute
EIA	Electronics Institute of America
EJMA	Expansion Joint Manufacturers Association
EIFSA	Exterior Insulation Finish Systems Association
EP	Environmental Protection Agency
FCI	Fluid Controls Institute, Inc.
FM	Factory Mutual
FS	Federal Specification
FS	Forest Stewardship Council
HEI	Heat Exchanger Institute
HI	Hydraulic Institute

HMI	Hoist Manufacturers Institute
HYDI	Hydronics Institute
IBI	Intelligent Buildings Institute
IBR	Institute of Boiler and Radiator Manufacturers
ICC	International Code Council (formerly ICBO, International Conference of Building Officials)
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IESNA	Illuminating Engineering Society of North America
IIA	Incinerator Institute of America
IPCEA	Insulated Power Cable Engineers Association
LEE	Leadership in Energy and Environmental Design Green Building Rating System (US Green Building Council)
MSS	Manufacturers Standardization Society
MCAA	Mechanical Contractors Association of America
NAAMM	National Association of Architectural Metal Manufacturers
NBC	National Building Code
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NCRP	National Council on Radiation Protection and Measurements
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NECS	National Electrical Code Standards
NEMA	National Electrical Manufacturers Association
NIST	National Institute of Standards and Technology
NFoPA	National Forest Products Association
NFPA	National Fire Protection Association
NOAA	National Oceanographic and Atmospheric Administration
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NSPE	National Society of Professional Engineers
NTMA	National Terrazzo and Mosaic Association
OSHA	Occupational Safety and Health Act
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing Drainage Institute
PS	Public Standard (U.S.Dept.of Comm.)
PTI	Post Tensioning Institute
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Markers Association
SBCCI	Southern Building Code Congress International, Inc.
SCAQM	South Coast Air Quality Management District
SC	Scientific Certification Systems
SDI	Steel Deck Institute / Steel Door Institute
SFPA	Southern Forest Products Association
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.

SPRI	Single Ply Roofing Institute
SSPC	Structural Steel Painting Council
TEMA	Tubular Exchanger Manufacturers Association
TIA	Telecommunications Institute of America
UBC	Uniform Building Code
UFC	Uniform Fire Code
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USGBC	US Green Building Council
WIC	Woodwork Institute
WWPA	Western Wood Products Association

END OF SECTION

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SECTION 01 42 13

ABBREVIATIONS FOR UNITS OF MEASURE - ENGLISH SYSTEM OF UNITS (IP)

A (amp)	ampere(s), area
ACFM	actual CFM
AIC	amps interrupting capacity
AWG	American Wire Gauge
BF	board foot (feet)
BHP	brake horsepower
BTU	british thermal unit
BTUH	british thermal units per hour
C Value	thermal conductance (BTU/(HR)(SF)(F) per inch thickness
CF	cubic feet
CFH	cubic feet per hour
CFM	cubic feet per minute
CM	centimeter(s)
CM/SEC	centimeter(s) per second
CPS	cycle(s) per second
CU	cubic
CU FT	cubic feet
CU IN	cubic inch(es)
CY	cubic yard(s)
Db	decibel(s)
DbmV	decibel millivolts
DEG	degree(s) (angular)
degF	degree(s) Fahrenheit
EDR	equivalent direct radiation
F	fahrenheit
FPM	feet per minute
FPS	feet per second
FT	feet, foot
GAL	gallon(s)
GAL/SF	gallon(s) per square foot
GPH	gallon(s) per hour
GPM	gallon(s) per minute
GPS	gallon(s) per second
GHZ	gigahertz
GR	grains
GSF	gross square feet
HD	head
HP	horsepower
HR	hour(s)
Hz	hertz

IN	inch(es)
IN Hg	inches - mercury
IN-LB	inch-pounds (force)
IN WG	inches - water gage
K	kip(s)
K value	thermal conductivity (BTU/(HR)(SF)(F/IN)
KHz	kilohertz
KSF	Kips per square foot
KV	kilovolt(s)
KVA	kilovolt ampere(s)
KVAR	kilovars
KW	kilowatt(s)
KWH	kilowatt-hours
LB	pound(s)
LBF-IN	pound (force) inch
LF	linear foot, linear feet
LIN	linear, lineal
mA	milliamps
MBTU	thousand BTU
MBH	thousand BTU/HR
MCFH	thousand cubic feet per hour
MCM	thousand circular mils
MFBM	thousand feet board measure
MHz	megahertz
mHz	millihertz
MI	mile(s)
MIN	minute(s)
MO	month(s)
MPH	miles per hour
MVA	megavoltamperes
NSF	net square feet
OZ	ounce(s)
PCE	pyrometric cone equivalent
PCF	pound(s) per cubic foot
PCY	pound(s) per cubic yard
PPH	pounds per hour
PPM	parts per million
PSF	pound(s) per square foot
PSI	pound(s) per square inch
PSIA	pound(s) per square inch absolute
PSIG	pound(s) per square inch gage
Q	total heat transfer (BTUH)
QT	quart
RH	relative humidity
R value	thermal resistance (HR)(SF)(F)/BTU
RMS	root mean square
RPM	revolutions per minute

RPS	revolutions per second
S	second
SCFM	standard CFM
SF	square feet
SQ IN	square inch(es)
SQ FT	square foot
SSU	saybolt seconds universal
T	ton
TR	tons refrigeration
U value	thermal conductance (1 divided by total R value) (BTU/(HR)(SF)(F))
uV	microvolts
V	volt(s), volume, velocity
VAC	volt(s), AC
VAR	volt amperes reactive
VDC	volt(s), DC
W	watt(s)
YD	yard(s)
YR	year(s)

END OF SECTION

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SECTION 01 43 39
MOCK-UPS (Revised AD-1)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Build indicated mock-up on site for review and approval before proceeding with any construction that may be affected by the construction represented by the mock-up.

1.2 PROCEDURE FOR MOCK-UP CONSTRUCTION:

- A. Extent, size, form and primary components are indicated on the drawings or in the specification section pertaining to the corresponding work.
- B. Mock-up shall be located where indicated on the drawings or, if not indicated, shall be located where directed by the Architect.
- C. Mock-up shall not be provided until corresponding product data, shop drawings, samples and other preparatory submittals are approved.
- D. Mock-up shall be rebuilt as necessary until approved by Architect.
- E. After approval, mock-up shall remain and serve as the standard for judging the acceptance or rejection of the appearance characteristics and workmanship of corresponding construction.
- F. After completion and acceptance of the corresponding construction, mock-up shall be removed when directed by the Laboratory unless approved mock-up has been located as part of the permanent construction.
- G. Surrounding and other construction affected by mock-up construction or removal shall be completed as indicated or, if construction is not indicated, the site shall be restored to the condition existing before the mock-up construction.
- H. Mock-up to include all project specific anchorages, flashings, transitions, colors, textures, etc.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials used in the initial mock-up construction shall comply as specified in the applicable sections for the work and as approved by submittal reviews.
- C. Materials used in the construction of approved mock-up construction shall be used in the corresponding permanent construction.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Provide initial mock-up construction by methods proposed for the corresponding permanent construction.
 - 1. Comply with installation and application requirements for each component as specified in the section applicable for the work.
- B. Methods of construction may be modified only to the extent required for mock-up approval by the Architect.

1. Modified methods of construction shall comply with the specified requirements as well as approved details of workmanship.
- C. Methods of construction used for the approved mock-up construction shall be used in the corresponding permanent construction.
- D. Re-testing of mock-up required due to non-compliant construction to be paid for by Contractor.

3.2 BUILDING ENCLOSURE WALL MOCK-UP #1 – SOUTH FAÇADE 2ND & 3RD FLOORS

- A. Provide mock-up of the building enclosure wall and window assembly as indicated.
- B. Sections specifying components of this mock-up include but are not necessarily limited to the following:
 1. Section 07 21 00, Building Insulation.
 2. Section 07 27 26 Fluid-Applied Air Barrier – Vapor Resistive
 3. Section 07 46 18 Dry Joint Metal Panel Wall System
 4. Section 07 84 53 Perimeter Fire Containment Systems
 5. Section 07 92 13, ExteriorJoint Sealants.
 6. Section 08 44 13 Curtain Wall Systems (CWS)
 7. Section 08 81 02, Glass and Glazing.
 8. Section 09 21 27, Exterior Stud Wall System.

AD-1:

END OF SECTION

SECTION 01 43 43
COORDINATION DRAWINGS (GC)

PART 1 - GENERAL

1.1 DESCRIPTION - INTERIOR

- A. Coordinate construction operations included in various Sections of Specifications to assure efficient and orderly installation of all parts of Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
- B. Coordination drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:
 - 1. In and above ceilings.
 - 2. Within walls.
 - 3. Within chases.
 - 4. In mechanical spaces.
 - 5. In electrical spaces.
- C. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.
- D. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
- E. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
- F. Work out all “tight” conditions involving Work of various Sections in advance of installation.
- G. Sleeve, core drill and blockout layout drawings:
 - 1. Drawings showing proposed locations and sizes of sleeves, blockouts, and embedded items in concrete walls, columns, floors and beams prior to concrete placement.
 - 2. See Structural drawings for limitations on sleeve placement.
 - 3. Core Drilling and cutting:
 - a. Core drilling and cutting are prohibited without express written approval of the Structural Engineer.
 - b. Prior to submitting a request for core drilling or cutting, the Contractor shall provide verification of location of reinforcing prior to cutting or core drilling by means of x-ray, ground penetrating radar, ultrasonic or other reliable means. Relocate as required to avoid reinforcing.
 - c. In no instance shall a column or beam be core drilled or cut.
- H. Prior to start of work in any given area, each Subcontractor approve, in writing, coordination drawings affecting Subcontractor’s work in that area.
- I. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications shall be paid for by responsible Subcontractor.
- J. Coordination meetings scheduled by Contractor, with all affected Subcontractors.

1.2 PRODUCTION OF COORDINATION DRAWINGS

- A. Contractor provide minimum 1/4 IN scale plan, elevation and section drawings, showing:
 - 1. Partitions.
 - a. Fire/smoke rated barriers.

2. Ceiling heights.
 3. Structural framing locations and elevations.
 4. Column lines.
 5. Other work.
- B. Subcontractors produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water systems, natural gas and medical gas systems electrical cable tray, conduit, conveying systems, equipment, and other work.
- C. Coordination Drawings shall be produced in Autodesk Revit 2010 or in Autodesk 3D AutoCad in conjunction with Autodesk Navisworks so they can be used for clash detection, to generate Shop Drawings, and to be updated at end of Project for Project Record Drawings.
1. Architect will furnish Contractor an electronic copy of the architectural model in Revit RVT format.
 - a. Revit model will indicate wall layout, column lines and room name and numbering.
 - b. Architect makes no representation as to accuracy or completeness of Revit model provided.
 2. Have skilled CAD technician(s) produce following plans using Autodesk Revit 2010 or Autodesk 3D AutoCad for Coordination Drawings and Shop Drawing submittals;
 - a. HVAC ductwork system.
 - b. Piping systems.
 - c. Plumbing systems.
 - d. Fire protection system.
 - e. Fire alarm system.
 - f. Communication and security systems.
 - g. Cable tray system.
 - h. Lightning protection system.
 - i. Building management system.
 3. Organization of systems in CAD file or Revit Model
 - a. 3D AutoCad: Indicate systems on separate CAD file with layers compliant with National CAD Standard to facilitate Coordination Drawings and Project Record Documents, using the background as an XREF to the coordination file.
 - b. Revit: Indicate systems on separate worksets within Revit model.
- D. Resolve major interferences at initial coordination meeting prior to production of any drawings.
- E. Produce initial coordination drawings within 30 days after initial meeting or prior to installation of work.
- F. Contractor arrange for production of said drawings not provided by that time.
- G. Meet as required to resolve interferences and correct drawings.

1.3 AFTER APPROVAL

- A. After Subcontractors' written approval of coordination drawings, Contractor determine method used to resolve interferences not previously identified.
- B. Contractor give written approval of changes to coordination drawings prior to start of work in affected area.
- C. Maintain one copy of current approved Coordination Drawings at project site.
- D. Provide 3D AutoCad files or Revit model for current coordination drawings to Laboratory and Architect after the final constructed conditions have been reflected in the coordination drawings.

1.4 PRECEDENCE OF SERVICES FOR COORDINATION DRAWINGS

- A. In event of conflicts involving location and layout of work; use following priority to resolve disputes:
 1. Structure and partitions have highest priority.

2. Equipment location and access.
3. Ceiling system and recessed light fixtures.
4. Gravity drainage lines.
5. High pressure ductwork and devices.
6. Large pipe mains, valves and devices.
7. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
8. Fire protection piping, devices and heads.
9. Small piping, tubing, electrical conduit, and devices.
 - a. Conduits installed in corridors shall be maintained at least 9 IN above finished ceiling. Conduits shall be grouped within a 12 IN width.
 - b. The space utilized for conduit shall be selected to allow access to all devices which normally require adjustment, repair, resetting, etc.
10. Sleeves through rated partitions.
11. Access panels.

1.5 PRODUCTION OF LAYOUT DRAWINGS

- A. Contractor provide scale plan and elevation drawings.
- B. Subcontractors indicate proposed location and size of their required sleeves, coredrills, blockouts and embedded items.
 1. At floor slabs and walls to be core drilled or cut, Find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer.
 2. Submit sketch showing location of rebar and proposed cores for review.

1.6 SUBMITTALS

- A. Project information:
 1. Contractor's approved Coordination Drawings.
 - a. Letter indicating one copy of approved Coordination Drawings available at project site.
 - b. One copy of approved Coordination Drawings to Architect for information, if requested.
 2. Contractor's proposed sleeve, coredrill and blockout layout drawings.
 - a. One copy of drawing to Architect for information.
 3. One set of 3D AutoCad files or Revit model for current coordination drawings after the final constructed conditions have been reflected in the coordination drawings for record drawing information.

END OF SECTION

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SECTION 01 45 00
FINAL OPERATIONAL TESTS

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Testing of all operational systems and assemblies in the facility for a continuous fourteen (14) day period after all systems are operational.
2. The test(s) shall be planned, coordinated and performed by qualified personnel of the Contractor and qualified subcontractors and manufacturer's representative, as required by the applicable tests, under direction of and with the participation of Laboratory or Laboratory's Designated Representative personnel. Prior to the Final Operational Test all personnel conducting the testing shall be fully trained in the operation of the systems tested. The Contractor shall maintain full responsibility for the facility and equipment operated during the Final Operational Test, maintain all guarantees and warranties, and repair any damage to the facility caused by the Final Operational Test.
3. The test period shall occur after published list of items on all of the equipment involved has been corrected and prior to acceptance or Substantial Completion.

B. Related work:

1. Specific test procedures to be performed on building components as required and specified in Divisions 02 through 41 of the Specifications, including but not limited to the following.
 - a. Soils and structural tests: Divisions 02 through 05.
 - b. Roofing and waterproofing tests and inspections: Division 07.
 - c. Testing of glazed assemblies when so specified: Division 08.
 - d. Testing of equipment specified in Division 11.
 - e. Testing of conveying systems: Division 14.
 - f. Testing of mechanical, electrical and communication systems: Divisions 20 thru 28.
 - g. Testing of materials specified to be tested by other agencies under other sections.
 - h. Commissioning: Division 01.

i. HVAC Controls and Instrumentation: Division 25.

C. Definitions:

1. Final Operational Test: Series of tests, as determined by Laboratory or Laboratory's Designated Representative, to be performed by the Contractor, subcontractors and manufacturers to determine the operational capabilities of the facility after all systems, except minor punch list items to be determined by Laboratory or Laboratory's Designated Representative, are completed and in operation.

1.02 TEST CRITERIA

- A. The Contractor shall advise the Laboratory in writing at least fourteen (14) days in advance of scheduling the Final Operational Test.
- B. All submittals, including operation and maintenance manuals, parts manuals, and record documents required by the Contract Documents Division 1 through 41 and all other tests, required by those Divisions (except the Final Operational Test) shall have been completed and furnished to Laboratory or Laboratory's Designated Representative.
- C. All building component and assembly(ies) tests specified in Divisions 2 through 41 of the Specifications shall have been completed, shall have successfully passed and shall have been approved before performance of the Final Operational Test.
- D. Operational and maintenance training of Laboratory or Laboratory Designated Representative designated personnel required by the Specifications shall have been successfully completed.
- E. Testing of all systems shall be made simultaneously in whatever combinations directed by Laboratory or Laboratory's Designated Representative.
- F. All building systems under the responsibility of the Contractor (electrical power, air conditioning, ventilation, heating, elevators, kitchen, low voltage, communications, telephone, etc.) shall be complete and proven fully operational before start of the Final Operational Test.
- G. All controlled movement of doors and gates shall be normally maintained in a secure position, unless otherwise directed by Laboratory or Laboratory's Designated Representative.
- H. Testing procedures shall be designed so as to simulate actual 24-hour operation of facility. Additional information about the operation of the facility may be obtained from Laboratory or Laboratory's Designated Representative during planning of the Final Operational Test.

- I. At an undetermined point during the test, Laboratory or Laboratory's Designated Representative will direct the Contractor to operate under emergency conditions for a period of time determined by Laboratory or Laboratory's Designated Representative, but not less than one full cycle. The sequence of operation shall be in accordance with the requirements of Specification Division 26 and will include.
 1. One electrical service failure.
 2. Complete loss of utility power resulting in transfer to emergency power, then returning to utility power source. The transfer from one power source to the other shall be on the automatic mode.
 3. One transformer, breaker or feeder failure in each unit substation.
 4. Fire and smoke management.
- J. During the Final Operational Test should any system malfunction or operate improperly, the Contractor shall repair the observed system malfunction within 24 hours of observation or written notice from Laboratory or Laboratory's Designated Representative.
 1. If repairs cannot be achieved satisfactorily within 24 hours, the Final Operational Test shall cease at the option of Laboratory or Laboratory's Designated Representative.
 2. Under that condition, a new Final Operational Test shall commence after the necessary repairs and/or re-work has been completed.

1.03 TEST COSTS

- A. Contractor shall pay all costs associated with the Final Operational Test including costs of utilities required to run the tests, but excluding cost of Laboratory or Laboratory's Designated Representative personnel witnessing or directing the tests, unless failure occurs.
- B. Contractor shall pay for any retesting as required or any re-start of the test as required.

1.04 TEST REPORTS

- A. Contractor shall furnish ten (10) type written copies of the test results, signed and certified.
- B. Reports shall include the following:
 - Date issued and date of the test.
 - Project title and Specifications number.
 - Testing personnel - name and affiliation.
 - Name and signature of personnel supervising the test.

- Record of exterior weather temperature.
- Record of interior temperature at five (5) control points to be determined by Laboratory or Laboratory's Designated Representative.
- Log of testing procedures and operational sequences.
- Log of operational failures and corrections of failures.

END OF SECTION

SECTION 01 49 90
SPECIAL SAFETY CONDITIONS

RELATED DOCUMENTS

Specification 1AO – General and specific references are made concerning Environment, Safety and Health requirements.

Appendix A of the Contract, Section 31 — Addresses general contractual requirements relating to Environment Safety, and Health for contractors working at Laboratory.

It is OSHA policy that all employers provide a safe and healthful workplace for their employees. In part, Argonne National Laboratory helps provide for safe and healthful work environment by implementing the program established in 10 CFR Part 851—Worker Safety and Health Program. To that end each Argonne contractor is responsible for ensuring compliance with “all applicable requirements” that govern their work at Argonne facilities, including any consensus standards incorporated therein by reference.

These references apply to all divisions of these specifications.

DESCRIPTION OF WORK

Reference GENERAL CONSTRUCTION SCOPE OF WORK DOCUMENT

GENERAL

The object of this specification section is to identify known and potential safety issues that exist in this contract. The additional guidelines and technical information are provided to insure that required and necessary safety precautions are planned for and executed on this project; however, this section is not fully comprehensive of all safety issues that could occur. The scope could change or unanticipated safety related issues could present themselves.

CONTRACTOR SAFETY ORIENTATION (CSO)

All contractor employees expecting to work at Argonne National Laboratory (Laboratory) shall attend the CSO. It is given Monday, Tuesday, Thursday, and Friday starting at 7:30 AM. No one is allowed into the training class after 7:35AM. The training is provided by the Laboratory in Building 202.

QUALITY ASSURANCE

The contractor shall come prepared to protect the safety of their employees, providing necessary safety equipment and standby personnel as required by all existing applicable industry related standards. Rigorously observe all the pertinent requirements of OSHA - Occupational Safety and Health Administration Regulations, 10 CFR Part 851—Worker Safety and Health Program, EPA - Environmental Protection Agency Regulations, recognized industry standards or recommendations including, but not necessarily limited to OSHA, ANSI, NIOSH, AWWA, ACGIH and SSPC.

The Contractor’s Site Specific Construction Safety Plan must be structured to address all the anticipated safety hazards to be encountered during the execution of the project. It will be the Contractor’s responsibility to demonstrate the methodology followed by the Contractor to define the project related hazards and the development of appropriate procedures to eliminate or mitigate those hazards.

The Laboratory will closely monitor compliance with all OSHA and related standards and may stop work at any time violations are observed. Such stoppage shall not relieve the contractor from fulfilling the completion date, nor shall it be a basis for any claims or additional costs.

CONSTRUCTION SAFETY

The contractor may employ a variety of methods to protect its workers and anyone near or entering the work area. A detailed description of the manner and methods used should be included in the safety documents.

This specification discusses a number of safety related issues that are expected to be encountered on this job but are not all inclusive.

The contractual requirements for the contractor's Safety Program are given in Appendix A, Argonne Terms and Conditions. The Laboratory will evaluate and approve the contractor's Environment, Safety, and Health Plan, otherwise known as a Site Specific Construction Safety Plan as described in the Appendix A, Argonne Terms and Conditions.

The Laboratory will evaluate the contractor's Site Specific Construction Safety Plan on the basis of recognized standards including, but not necessarily limited to OSHA - Occupational Safety and Health Administration Regulations, 10 CFR Part 851—Worker Safety and Health Program, EPA - Environmental Protection Agency Regulations, recognized industry standards or recommendations including, but not necessarily limited to OSHA, ANSI, NIOSH, AWWA, ACGIH and SSPC.

CONTRACTOR JOB SAFETY ANALYSIS (JSA)

The Laboratory will participate in the evaluation of JSAs developed by each subcontractor for the first three hands-on activities they will perform. The JSA is to define the steps that will take place on the job, the hazards expected to present within each step, and the precautions that will be taken to mitigate the anticipated hazards

A blank JSA form is included with the contract documents. **The Contractor may use this form or a form of its own choosing that specifically addresses the aforementioned steps. All items discussed in this specification should be addressed as a minimum. Any other hazards that you suspect could occur should be addressed and included in the JSA.** Lifts plans, training, certificates, etc. that are referenced and MSDS documents shall be included with the JSA. The initial review of the JSAs may take up to 10 days to review. The JSAs must be accepted by Argonne prior to the Contractor granting the subcontractor "Authorization to Proceed."

SPECIFIC SAFETY TOPICS

Are detailed in the Argonne Site Specific Construction Safety Plan and Guide.

SUBMITTALS

General: Refer to General, Special Conditions, and Appendix A for general submittal requirements. A JSA shall be submitted for review and approval by the Laboratory.

PRE-CONSTRUCTION MEETING

A pre-construction meeting will be scheduled by the Laboratory within one week after the construction contract is awarded, but prior to start of any construction work. This meeting will include a review off the Contractor's Site Specific Construction Safety Program. The Argonne Project Manager will also address in detail the Job Safety Analyses for the first three tasks to conducted on site, in order to establish a "Benchmark" and agreement regarding the level of detail that will be included in the development of JSAs.

For this meeting to be effective the Contractor's documentation must have been received and accepted by the Laboratory prior to this meeting occurring.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

1.00 GENERAL

1.01 DESCRIPTION

- A. Provide all temporary facilities and controls required for the performance of the work. Maintain temporary facilities and controls as long as needed for the safe and proper completion of the Work. Remove temporary facilities and controls as rapidly as progress of work will permit and restore surfaces damaged by temporary facilities and controls to their original condition.
- B. Supervise the use of all temporary facilities and controls. Enforce compliance with applicable standards. Prevent abuses of services.
- C. Submit a mobilization and staging plan.
- D. Temporary facilities include, but are not limited to:
 - 1. Temporary utilities:
 - a. Temporary electric lighting and power.
 - b. Temporary water.
 - c. Temporary telephone and data service.
 - d. Temporary sanitary facilities.
 - e. Temporary first aid, fire protection and other temporary facilities in accordance with legal requirements.
 - 2. Construction aids.
 - 3. Barriers.
 - 4. Special controls.
 - 5. Traffic regulations.
 - 6. Construction fence.
 - 7. Temporary project signage.
 - 8. Temporary sidewalks, canopies, bridge, curbs, gutters and pavement markings.

9. Hoisting

- E. Unless otherwise noted elsewhere in the Contract Documents, all costs of installation, operation, maintenance and removal of all temporary facilities shall be borne by the Contractor.

1.02 MOBILIZATION AND STAGING PLAN

- A. Submit a mobilization and staging plan to Laboratory or Laboratory's Designated Representative before starting any work on the site.
- B. Include staging for major equipment, material deliveries, parking and temporary structures.

1.03 LIGHT AND POWER

- A. Provide and maintain in a safe manner and utilize so as not to constitute a hazard to persons or property.
- B. Comply with legal requirements.

1.04 WATER

- A. Provide and maintain temporary water service for drinking and construction purposes for all parts of the work.

1.05 TELEPHONES AND DATA

- A. Provide temporary telephone service for construction needs throughout the construction period. Provide at least one (1) telephone and one (1) data jack in the Contractor's field office.

1.06 TOILETS

- A. Provide and maintain temporary portable toilets and other sanitary facilities for all workmen on the Project as required by, and in accordance with, legal requirements.

1.07 CLEANUP

- A. Each Contractor will be responsible to furnish labor and disposal means to adequately keep project clean and uncluttered at all times of construction. Debris, shipping containers, etc. will be removed from the site on a daily basis and disposed of off-site.
- B. Contractor shall take steps to prevent construction traffic dirt and debris deposits on Laboratory roadways. Contractor shall promptly remove such dirt and debris from Laboratory roadways.

1.08 FIRST AID/FIRE PROTECTION/OTHER TEMPORARY FACILITIES

- A. Provide as required by, and in accordance with, legal requirements. The local fire authority shall be consulted regarding on-site fire protection during the demolition and construction phases.

1.09 TEMPORARY GRADING AND DEWATERING

- A. As specified in Specification Division 31, maintain temporary protection as long as needed, and until permanent draining and grading is completed and operating.

1.10 HOISTING

- A. Provide and maintain all temporary hoisting, hoists, elevators or lifts necessary to complete the work.

1.11 MISCELLANEOUS TEMPORARY CONSTRUCTION AIDS

- A. Provide and maintain all miscellaneous temporary construction aids required for proper execution of the work, such as stairs, ladders, ramps, railings, canopies, scaffolds and hoists, chutes, barricades, enclosures, platforms, swing staging and walks.
- B. Locate in and about the Project as is practical and where they will not interfere with the progress of the work. Relocate when necessary during construction, and remove promptly when no longer needed.

1.12 BARRIERS

- A. Security:
 - 1. Laboratory shall not in any way be liable or responsible for the damage or loss to the work due to trespass or theft.
 - 2. Provide protection for materials, tools and equipment employed on the Project including the workmen tools. Laboratory shall not be held to have incurred any liability for loss of, and damage to, materials, tools and equipment of the Contractor, or of those employed by Contractor, by contract or otherwise.
- B. Protection:
 - 1. Continuously maintain protection as necessary to protect the work as a whole and in part, and adjacent property and improvements from accidents, injuries or damage.
 - 2. Properly protect the work:

- a. With lights, guard rails, temporary covers, and barricades.
 - b. Enclose excavations with proper barricades.
 - c. Brace and secure all parts of the work against storm and accident.
 - d. Provide such additional forms of protection which may be necessary under existing circumstances.
3. Provide and maintain in good condition all protective measures as may be required to adequately protect the public from hazards resulting from the work and to exclude unauthorized persons from the work. When regulated by Building Code and other public authorities having jurisdiction, such legal requirements for protection shall be considered as minimum requirements; be responsible for the protection in excess of such requirements as required.

1.13 SHORING

- A. Work included: Provide shoring at excavations and elsewhere as required to protect workmen, materials, utilities, other properties, and the public. Shoring shall not damage or interfere with the operation of any utilities or adjacent properties and shall not interfere or hamper the completion of the construction work on site.
- B. The Contractor is solely responsible for means and methods of construction and for the sequences and procedures to be used.
- C. Employ a qualified engineer, properly permitted to provide such services at the location of the Work, to design the shoring system and to inspect and report on the quality of its construction.
- D. Comply with pertinent requirements of governmental agencies having jurisdiction.

1.14 POLLUTION CONTROL

- A. Comply with all pollution control regulations in effect at site for all materials, equipment and work procedures used on the Project.
- B. Control dust during demolition and sitework.
- C. Require all trailers carrying debris, fill and earth from the site to be covered.

1.15 TRAFFIC REGULATION

- A. Traffic maintenance: Determine the routing of construction vehicles before starting work, based on restrictions indicated on the Drawings and the safeguards and procedures necessary to carry out the work.

1. In addition:
 - a. Be responsible for controlling construction traffic within and adjacent to the site.
 - b. Provide all entrances, lifts and safeguards required or necessary to the progress of the work, and effectively control such traffic to provide minimum hazard to the work and all persons.
 - c. Route all construction equipment, trucks, and similar vehicles via existing public streets to and from the site as approved by the governing authorities.
 - d. Obtain and pay for permits and inspections necessitated by the use of public streets, sidewalks, curbs, and paving. Post guarantees and bonds that may be required, and repair and make good any damages thereto, acceptable to the authorities having jurisdiction.
 - e. Construct and maintain temporary walks and ridges for pedestrians. Keep streets adjacent to the site open to vehicular and pedestrian traffic.
 - f. Maintain constant access for police, fire and ambulance service.
 - g. Provide and maintain for proper control of traffic and safety of all concerned:
 1. All necessary barricades, suitable and sufficient lights, reflectors, and danger signals.
 2. Warning and closure signs, directional and detour signs.
 - h. Indicate on a twenty four (24) hour basis all restricted and dangerous conditions existing on or adjacent to the site.
 1. Illuminate barricades, danger signals, warning signs and obstructions at night.
 2. Keep warning lights burning from one hour before sunset until one hour after sunrise.
- B. Parking: Parking shall be subject to the requirements and designated area as determined by Laboratory.

1.16 PROJECT SIGNAGE

- A. Furnish and install project signage as directed by Laboratory or Laboratory's Designated Representative.

1.17 FIELD OFFICES AND STORAGE SHEDS

- A. Furnish, install and maintain a field office for the Contractor's use. Equip the office with lights, heat, air conditioning, desks, chairs, plan racks, telephones and other items necessary for the performance of the work.
- B. Furnish, install and maintain storage sheds needed for construction.
- C. Comply with requirements of regulatory agencies having jurisdiction. Obtain and pay for permits required by governing authorities.
- D. Locate temporary structures to avoid interference with work in progress and relocate as required by job progress.

1.18 REMOVAL

Remove temporary facilities and controls upon completion of construction operations or when they are no longer needed, whichever occurs first. Remove temporary fencing, sign, foundations, debris; grade to required elevations and clean area of debris. Restore areas to original condition as directed by Laboratory or Laboratory's Designated Representative.

END OF SECTION

SECTION 01 52 00
CONSTRUCTION AIDS

1.00 GENERAL

A. Requirements Included:

1. Unless specifically noted otherwise in Section 01001 and attachments, each Contractor shall furnish, install and maintain required construction aids and upon completion of their use such aids shall be removed from the site.
2. Related requirements:
 - a. Section 01 04 00: Project Coordination.
 - b. Section 01 50 00: Construction Facilities and Temporary Controls.
 - c. Section 01 53 00: Barriers.

1.01 Products

A. Materials, General:

1. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

B. Construction Aids:

1. Provide construction aids and equipment required by personnel and to facilitate the execution of the work, i.e., scaffolds, shoring, piling, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.
 - a. Refer to respective Specification Sections for particular requirements for each trade.
 - b. When permanent stair framing is in place, provide temporary treads, platforms, and railings for use by construction personnel.
 - c. Maintain all facilities and equipment in a first-class condition.

C. Temporary Enclosures:

1. Provide temporary enclosures per Specification Section 01 50 00.

1.02 Execution

A. Preparation:

1. Consult with Laboratory or Laboratory's Designated Representative, review site conditions and factors which affect construction procedures and construction aids, including adjacent properties and public facilities which may be affected by execution of the Work.

B. General:

1. Comply with applicable requirements specified in Specification Sections of Divisions 02 through 41.
2. Relocate construction aids as required by progress of construction by storage or work requirements, and to accommodate legitimate requirements of Laboratory and other Contractors employed at the site.

C. Removal:

1. Completely remove temporary materials, equipment, and services:
 - a. When construction needs can be met by use of permanent construction.
 - b. At completion of the Project.
2. Clean and repair damage caused by installation or by use of temporary facilities.
 - a. Remove foundations and underground installations for construction aids.
 - b. Grade the areas of the site affected by temporary installation to required elevations and slopes, and clean the area.
3. Restore permanent facilities used for temporary purposes to specified condition.

END OF SECTION

SECTION 01 53 00
BARRIERS

1.00 GENERAL

A. Requirements Included:

1. Furnish, install, and maintain suitable barriers as required to prevent public entry, and to protect the Work; remove when no longer needed or at completion of Work.

B. Related Requirements:

1. Drawings, Section 01 00 10 and attachments, Division 0 Documents, and other Division 01 Specification Sections, apply to this Section.
2. Section 01 04 00: Project Coordination.
3. Section 01 52 00: Construction Aids.

1.01 Products

A. Materials, General:

1. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

1.02 Execution

A. General:

1. Install facilities of a neat and reasonably uniform appearance, structurally adequate for required purposes.
2. Maintain barriers during entire construction period.
3. Relocate barriers as required by progress of construction.

B. Removal:

1. Completely remove barricades, including foundations when construction has progressed to the point that they are no longer needed, and when approved by Architect and Laboratory or Laboratory's Designated Representative.
2. Clean and repair damage caused by installation, fill and grade areas of the site to required elevations and slopes, and clean the area.

END OF SECTION

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SECTION 01 55 00
SITE SECURITY

1.00 GENERAL

1.01 Security Requirements

- A. Laboratory or Laboratory's Designated Representative assumes no responsibility for loss, theft or damage to the work, tools, equipment and/or construction. In the instance of any such loss, theft or damage, the Contractor shall be responsible to renew, restore or remedy the work tools, equipment and construction in accordance with requirements of the Contract Documents without additional cost to Laboratory.
- B. The Contractor, at his own cost and expense may provide means of site security as he deems necessary.
 - 1. Contractors shall advise Laboratory or Laboratory's Designated Representative of any theft or damage which might delay the execution of the Work.
 - 2. Contractors are to furnish Laboratory or Laboratory's Designated Representative with a copy of any theft report filed with local, county or state agencies.
- C. Site-parked equipment, operable machinery and hazardous parts of the new construction subject to mischief and accidental operation shall be inaccessible, locked or otherwise made inoperable when left unattended.
- D. Laboratory may, as a courtesy only, provide surveillance and security as it deems necessary within the construction site.

1.02 Security Procedures

- A. Selected entrances to the construction site will remain open during normal working hours for use by all Contractors. Contractors shall utilize specific entrances for material deliveries, equipment deliveries and workmen access to the construction site as directed by Laboratory or Laboratory's Designated Representative.
- B. Laboratory or Laboratory's Designated Representative may, as the project progresses, establish additional security policies and procedures. Contractors shall cooperate with Laboratory or Laboratory's Designated Representative in implementing additional procedures.
- C. Laboratory or Laboratory's Designated Representative is not responsible for damage, liability, theft, casualty or other hazard to the automobiles or other vehicles, nor to

injury including death to occupants of automobiles or other vehicles on Laboratory 's property.

END OF SECTION

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SECTION 01 57 00
FIRE PROTECTION

1.00 GENERAL

A. Description of Requirements

1. Specific administrative and procedural minimum actions are specified in this Section, as extensions of provisions in Fixed-Price Construction Contract between UChicago Argonne, LLC and Contractor and other Contract Documents. These requirements have been included for special purposes as indicated. Nothing in this Section is intended to limit types and amounts of fire protection required, and no omission from this Section will be recognized as an indication by Laboratory or Laboratory's Designated Representative that such temporary activity is not required to successful completion of the work and compliance with requirements of Contract Documents. Provisions of this Section are applicable to, but not by way of limitation, security/protection provisions.

B. Quality Assurance

1. NFPA Code: Comply with NFPA Code 241 "Building Construction and Demolition Operations".
2. Contractor shall also comply with all applicable state, city and local fire codes.

1.01 Fire Precautions and Protection

- A. The Contractor shall take all necessary precautions to guard against all possible fire hazards and to prevent damage to any construction work, building materials, equipment, field offices, storage sheds and all other property, both public and private, in accordance with all fire protection and prevention laws and codes. Assume full responsibility for damage caused by fire to construction and building materials, equipment and all property, both public and private.
- B. The location of the nearest corporation or public fire alarm box and the number of the local fire department shall be conspicuously posted by the Contractor in field offices and in the building construction adjacent to the Work.
- C. Prevent heavy concentrations of materials where they might be consumed by a single fire. Equipment stored in the open should be kept in low piles and with adequate space between piles. This arrangement will provide fire breaks and access for fire fighting.

END OF SECTION

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SECTION 01 59 00
FIELD OFFICES, STORAGE & PARKING FACILITIES

1.00 GENERAL

1.01 Related Documents

- A. Applicable requirements of Fixed-Price Construction Contract between UChicago Argonne, LLC and Contractor apply to work specified in this Section.

1.02 Requirements Included

- A. Temporary Field Offices and Storage Trailers.
- B. Employee and Vehicle Parking.
- C. Temporary Storage Areas.
- D. Security of Stored Materials.

1.03 Related Requirements

- A. Section 01 00 10 – Special Conditions.
- B. Section 01 50 00 - Construction Facilities and Temporary Controls.

1.04 Temporary Field Offices and Storage Trailers

- A. Space will be assigned by Laboratory or Laboratory's Designated Representative for each Contractor's Field Office and Storage Trailers within the site. Limited space is available to all Contractors.
- B. Laboratory or Laboratory's Designated Representative reserves the right to prohibit office or storage trailers that are of flammable construction, in need of repair or otherwise objectionable.
- C. The Contractor shall keep its assigned office and storage area clean and dispose of its debris and trash promptly. The office and/or storage trailers shall not be used for living quarters and shall be of suitable design and appearance. The Contractor shall remove all office and storage trailers within ten (10) days of written notice from Laboratory or Laboratory's Designated Representative. Trailers not removed in a timely manner will be removed by Laboratory or Laboratory's Designated Representative at the Contractor's expense.

1.05 Employee and Vehicle Parking

- A. Employee parking shall be north of Building 202 per the Laboratory designated requirements and area.
- B. Employee vehicles shall not be used within the construction work area. The Contractor shall restrict the use of vehicles to company owned vehicles having appropriate insurance in accordance with the Agreement Between UChicago Argonne, LLC and Contractor. Any vehicle within the construction work area will be attended by the driver or operator at all times.

1.06 Temporary Storage Areas

- A. There will be limited space on site for storage of materials and equipment. Contractors shall not bring materials and/or equipment to the site until they are needed for the progress of the work, unless otherwise approved by Laboratory or Laboratory's Designated Representative.
- B. Storage of materials within the building structure will only be allowed when approved by Laboratory or Laboratory's Designated Representative. The Contractor shall not store flammable materials within or adjacent to the building structure, and all such flammable materials shall be clearly identified and properly stored, with approval of Laboratory or Laboratory's Designated Representative.
- C. The Contractor shall coordinate the extent of fuels stored on site and location of fuel storage tanks with Laboratory or Laboratory's Designated Representative. Fuel shall be stored and located in accordance with the requirements of Local Authorities and governing laws. Spill protection shall be provided at all fuel storage areas and at any area where flammable solvents or other liquids are stored or dispensed.

1.07 Security of Stored Materials

- A. Laboratory assumes no responsibility for materials stored in the building or on the site. The Contractor accepts the full responsibility for damage or theft due to on-site storage of construction related material and equipment.
- B. The Contractor shall coordinate its security procedures with Laboratory or Laboratory's Designated Representative and receive approval prior to proceeding with additional security measures.

END OF SECTION

SECTION 01 60 00
MATERIAL & EQUIPMENT

1.00 GENERAL

1.01 Requirements Included

- A. Products
- B. Transportation and handling

1.02 Related Requirements

- A. Drawings, Section 01 00 10, Division 00 Documents and other Division 01 Specification Sections, apply to this Section.
- B. Section 01 40 00 - Quality Control: Submittal of manufacturers' certificates.
- C. Section 01 73 00 – Operation Manuals: Operation and Maintenance Data.
- D. Section 01 73 50 – Maintenance Manuals: Spare Parts and Maintenance Materials.

1.03 Products

- A. Products include materials, equipment and systems.
- B. Comply with specifications and referenced standards as minimum requirements.
- C. Components required to be supplied in quantity within a specification section shall be the same, and shall be interchangeable.
- D. Do not use materials and equipment removed from existing structure, except as specifically required, or allowed, by Contract Documents.

1.04 Transportation and Handling

- A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

- D. Limited use of floor and/or decks for staging/laydown will be allowed only for material needed for immediate installation as approved by Laboratory or Laboratory's Designated Representative.
- E. For hoisting provisions see Specification Section 01 50 00.

END OF SECTION

SECTION 01 61 50
PRODUCT HANDLING

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. This Section establishes general requirements for product handling and storage, whether on or off the site, and supplements similar provisions found elsewhere in the Contract Documents.

B. Related work or requirements:

1. Handling provisions for OFCI items are specified in Specification Section 01 01 00.
2. Storage of materials on site must be in accordance with the approved mobilization and staging plan specified in Specification Section 01 50 00.

1.02 HANDLING

A. General: Transport, deliver, handle, and store all materials and equipment used on the Project to prevent the intrusions of foreign matter, moisture, and to prevent damage. In all cases comply with the following.

1. Material and equipment manufacturer's instructions regarding temperature limitations.
2. Other environmental conditions which are required to maintain the original quality of the materials and equipment.

B. Packaging:

1. Provide packaged materials in their manufacturer's original containers with seals unbroken and labels intact until incorporating into the work.
2. Wrapped or bundled materials shall clearly bear the manufacturer's name and trade mark.

C. Damaged materials: Remove damaged or otherwise unsuitable material and equipment promptly from the site. Do not install damaged materials.

1.03 STORAGE

- A. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
- B. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- C. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
- D. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
- E. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
- F. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- G. Locate storage piles, stacks or bins to avoid being disturbed, and protect from damage of any sort.
- H. Store materials and equipment in accord with manufacturer's instructions, above grade, and properly protected from weather and construction activities.
- I. Payment may be withheld for improperly packaged and stored materials.

1.04 PROTECTION

- A. Protect all finished surfaces, including floors jambs and soffits of all openings used as passageways or through which materials and equipment must travel.
- B. Keep finished surfaces clean and unmarred until the date of acceptance.
- C. Refer to individual Specification Sections for additional specific product handling and protection requirements.

END OF SECTION

SECTION 01 63 00
MATERIALS AND EQUIPMENT SUBSTITUTIONS

1.00 GENERAL

1.01 PRODUCTS

A. General:

1. When product number or model specified has been discontinued or changed by the specified manufacturer between the time the Project is bid and the purchase order is placed by the Contractor, the Contractor shall, at no additional cost to Laboratory, provide a substitute product from the same manufacturer which Laboratory considers equal to or better than the product specified.
 - a. If the manufacturer specified no longer makes an equivalent or better product than specified, product from another manufacturer, which in Laboratory's opinion is equal to or better than product specified, shall be provided.
 - b. Submittals for substituted product shall comply with the requirements of the Contract Documents including Specification Sections 01 33 00 and 01 63 20.
2. Whenever possible, provide products of the same kind, from a single source, in ample quantities to facilitate proper and timely execution of the work.
3. When specified products are available only from sources that do not or cannot produce a quantity adequate for the Project requirements in a timely manner, consult with the Architect and Laboratory for a determination of the most important product qualities before proceeding.
 - a. Qualities may include attributes related to visual appearance, strength, durability, or compatibility.
 - b. When a determination has been made, select products from sources that produce products that possess these qualities.
4. Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise specified, unused at the time of installation.
 - a. Provide products complete with all accessories, trim finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

- b. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Compatibility of options: When the Contractor is given the option of selecting between two (2) or more products for use on the Project, the Contractor shall verify that product selected will be compatible with the products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is inconspicuous.
 - 2. Equipment nameplates:
 - a. Provide a permanent nameplate on each item of service-connected or power-operated equipment.
 - b. Locate on an easily accessible surface which is inconspicuous in occupied spaces.
 - c. The nameplate shall contain the following information and other essential operating data:
 - Name of product and manufacturer.
 - Model and serial number.
 - Capacity.
 - Speed.
 - Ratings.

1.02 CONTRACTOR'S OPTIONS

- A. Product selection is governed by the Contract Documents and governing regulations. Procedures governing product selection include the following:
 - 1. When both the specified process and the guarantee of the results are specified, the Contractor shall, if in Contractor's judgement the process may not produce the required result, offer for review an alternative process which he would guarantee.
 - 2. Where Specifications require matching an established sample or samples when a color range is given, the Architect's decision will be final on whether a proposed product matches satisfactorily.

- a. Where no visual match can be satisfactorily made, in the Architect's opinion, even though the product selected conforms to other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
- b. Where specified product requirements include the phrase "as selected from manufacturer's palette..." or "as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, the Architect will select the color, pattern and texture from the product line selected.

1.03 TRANSPORTATION AND HANDLING

- A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- D. For hoisting provisions see Specification Section 01 50 00.

END OF SECTION

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SECTION 01 63 20
REQUESTS FOR POST-PROPOSAL SUBSTITUTION

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Post-proposal substitutions

1.02 SUBSTITUTIONS

- A. Base Proposal shall be in accordance with the Contract Documents and specifications.
- B. After the end of the proposal period, substitution requests will be considered only in case of:
1. Product unavailability
 2. Other conditions beyond the control of the Contractor
 3. Items listed as “or equal” products
- C. Submit requests for substitutions on form attached. Submit a separate request form for each substitution. Support each request with the following information:
1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
 - a. Product identification, including manufacturer’s name and address.
 - b. Manufacturer’s literature, identifying:
 - 1) Product description.
 - 2) Reference standards.
 - 3) Performance and test data.
 2. Itemized comparison of the proposed substitution with product specified, listing significant variations.
 3. Data relating to changes in construction schedule.
 4. Effects of substitution on separate contracts.
 5. List of changes required in other work or products.
 6. Accurate cost data comparing proposed substitution with product specified.
 - a. Amount of net change to Contract Sum.
 7. Designation of required license fees or royalties.
 8. Designation of availability of maintenance services sources replacement materials.

- D. Substitutions will not be considered for acceptance when:
 - 1. A substitution is indicated or implied on shop drawings or product data submittals without a formal request from the contractor.
 - 2. Acceptance will require substantial revision of Contract Documents.
 - 3. In judgment of Laboratory's designated Project Manager, the substitution request does not include adequate information necessary for a complete evaluation.
 - 4. Requested directly by a subcontractor or supplier.
- E. Does not order or install substitute products without recommendation of the Laboratory's designated Project Manager and acceptance by the Laboratory.
- F. Laboratory's designated Project Manager will determine acceptability of proposed substitutions.
- G. No verbal or written approvals other than by Change Order will be valid.

1.03 CONTRACTOR'S REPRESENTATION

- A. In making formal request for substitution the Contractor represents that:
 - 1. The proposed product has been investigated and it has been determined that it is equivalent to or superior in all respects to the product specified.
 - 2. The same warranties or bonds will be provided for the substitute product as for the product specified.
 - 3. Coordination and installation of the accepted substitution into the Work will be accomplished and changes as may be required for the Work to be complete will be accomplished.
 - 4. Claims for additional costs caused by substitution which may subsequently become apparent will be waived by the Contractor.
 - 5. Complete cost data is attached and includes related costs under the Contract, but not:
 - Costs under separate contracts.
 - Laboratory's designated Project Manager's costs for redesign or revision of Contract Documents.

1.04 SUBSTITUTION REQUEST FORM

- A. The form is attached to this Section.
- B. Substitutions will be considered only when the attached form is completed and included with the request for substitution submittal and back-up data.

REQUESTS FOR SUBSTITUTION FORM

TO: Argonne National Laboratory
9700 S. Cass Avenue
Argonne, IL 60439-4836

Date: _____

Attn: _____

PROJECT NAME _____

We hereby submit for your consideration the following product instead of the specified item for the above project:

DRAWING NO. _____ DRAWING NAME _____

SPEC. SECT.	SPEC NAME	PARAGRAPH	SPECIFIED ITEM
_____	_____	_____	_____

Proposed Substitution:

Fill in the blanks below:

A. Does the substitution affect dimensions shown on Drawings?
Yes ___ No ___ If yes, clearly indicate changes.

B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?
Yes ___ No ___ If no, fully explain:

C. What effect does substitution have on other Contracts or other trades?

D. What effect does substitution have on construction schedule?

E. Manufacturer's warranties of the proposed and specified item(s) are:
_____ Same _____ Different.
Explain _____

F. Reason for request: _____

G. This substitution will amount to a credit or extra cost to the Laboratory of:

H. Designation of maintenance services and sources:

(Attach additional sheets if required.)

Attach complete information on changes to drawings and/or Specifications which proposed substitution would require for its proper installation.

Submit with request necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance.

Signature shall be by person having authority to legally bind the Contractor to the above terms. Failure to provide legally binding signature will result in retraction of approval.

The undersigned certifies that the function, appearance and quality are of equal performance and assumes liability for equal performance, equal design and compatibility with adjacent materials.

Submitted By:

Signature (Contractor)

Title

Firm

Address

Telephone

Date

For use by the Laboratory:

____ Approved

____ Not Approved

____ Approved as noted

By _____

Date _____

END OF SECTION

SECTION 01 65 00
OPERATIONAL TRAINING

1.0 GENERAL

Coordinate work associated with this Section with the requirements of Divisions 01 through 41.

1.1 DESCRIPTION

- A. The Contractor shall train Laboratory's personnel in the operation of systems and equipment listed in this Section and as mentioned in other sections. Coordination shall be maintained with systems designers for developing the hours of instruction and scope of material to be covered. Training of Laboratory personnel shall not begin until Laboratory has approved the final submittal copy of the operation manuals and training programs, and the building systems and equipment are complete and operational.
- B. Schedule Submittal. The proposed scope of training and materials and instruction schedule shall be submitted for review and approval approximately 30 days before the scheduled completion of the work for which training is to occur. Mutually agreeable dates for training shall be arranged with Laboratory, but the training shall be completed before the Final Operational Test.
- C. The training required in this Section is in addition to the required training/demonstration indicated in the technical sections of the specifications.

1.2 COORDINATED EFFORT

- A. The Contractor or Contractor provided professional training firm shall work closely with Laboratory personnel in the development and implementation of the training program. This includes preliminary meetings to map out the direction the training will take and development, with Laboratory approval, of the written training materials.

2.0 REQUIREMENTS

2.1 SCOPE OF TRAINING

- A. Training must include classroom and on-the-job (hands-on) instructions by qualified installation and operation personnel having the necessary knowledge, experience, and teaching skills. The use of videotaping during the instruction period is encouraged. If this technique is used, tapes must be turned over to Laboratory after training has been completed. The Contractor shall video record all on-the-job (hands-on) instructions and turn over to the Laboratory copies of the video recordings.

2.2 RESPONSIBILITY OF TRAINING

- A. The Contractor provided training will be directed at a group of Laboratory personnel who will act as a training cadre.
- B. The Contractor is responsible for providing training to this cadre in all systems and equipment to operate the Energy Sciences Building.
- C. This cadre will then be responsible for training Laboratory personnel assigned to the Energy Sciences Building.

2.3 LEVEL OF EXPERTISE OF INSTRUCTORS

- A. Contractor may use professional training firms. Credentials of training instructors for the following systems are subject to review and approval by Laboratory.
 - 1. Conveying Systems
 - 2. Mechanical Systems
 - 3. Electrical and Low Voltage Systems
 - 4. Miscellaneous Systems

2.4 TRAINING PROGRAM AND MATERIALS

- A. The training program, in its entirety, shall be furnished by the Contractor and shall become the property of Laboratory. This includes but is not limited to:
 - 1. All lesson plans, teachers' guides or training aids used to instruct the students. One complete set shall be given to Laboratory.
 - 2. All written materials. e.g. workbooks, manufacturers' instructions, brochures, student tests, charts or other printed or photographed visual aids. Three (3) sets with one complete reproducible master shall be given to Laboratory.
 - 3. All audio visual materials e.g. video tapes, 35mm slides, film and audio cassettes, overhead projector transparencies or other audio visual medium. Three sets shall be given to Laboratory.
 - 4. All equipment related to the conveyance of the training program e.g. VHS video cassette recorders, color TV monitors, slide projectors, movie projectors, cassettes players, overhead projector, or other related equipment. Non-permanent mounted white boards, cork board and projector screens.
 - 5. All video recordings of training conducted by the Contractor.

2.5 CLASSROOM TRAINING

- A. Classroom training shall be conducted in a classroom furnished by Laboratory.

3.0 TRAINING PERIOD

3.1 TIME PERIOD OF TRAINING

- A. The minimum specific hours of training time required for each category of major equipment and systems shall be in accordance with the specific specification sections that pertain to the major equipment or systems. Laboratory must have the option of redistributing the training times, subject to the total time specified. Training must be presented on an 8-hour per day, 5-day per week schedule, with all reading assignments and review to be within this period. (Note: eight (8) hour training days include 1/2 hour lunch.)

END OF SECTION

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SECTION 01 70 00
CONTRACT CLOSEOUT

1.00 GENERAL

1.01 DESCRIPTION

- A. Provide all operations necessary for closing out the Contract and assisting in Laboratory's final inspection/examination.
- B. Definitions: Closeout is hereby defined to include general requirements near end of Contract Time, in preparation for final acceptance, final payment, normal termination of contract, occupancy and similar actions evidencing completion of the Work. Specific requirements for individual units of work are specified in Sections of Division 1 through 41. Time of closeout is directly related to "Substantial Completion", and therefore shall be a single time period for the entire work. If Laboratory exercises the right to take possession as described in Clause 30 of Appendix A, then substantial completion shall be a single time period, or a series of time periods for individual parts of the work which have been noted a substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section. "Substantial Completion" shall be defined and determined by Laboratory as "providing beneficial occupancy and/or use by Laboratory".

1.02 COMPLETION OF WORK

- A. Prior to requesting inspection by Laboratory or Laboratory's Designated Representative, inspect the Work to verify that it is completed in accordance with Contract Documents, and any authorized modifications thereto, and is ready for the requested inspection.

1.03 PREREQUISITES TO SUBSTANTIAL COMPLETION:

- A. General: Prior to requesting inspection for certification of "Substantial Completion" (for either entire work or portions thereof), the CONTRACTOR shall complete the following and list known exceptions in the request:
 - 1. In progress payment request, coincident with or first following date claimed, show either 100% completion for portion of work claimed as "complete", and provide "punch-list" of incomplete items, value of incompleteness, and reasons for being incomplete. Include supporting documentation for completion as indicated in these contract documents.
 - 2. Complete commissioning, start-up, testing of systems, and Instruction/Training to Laboratory's operating/maintenance personnel. Discontinue (or change over) and remove from project site temporary facilities and services, along with construction tools and facilities, and similar elements.
 - 3. Thoroughly clean building and site per Section 01 71 00.
 - 4. All plumbing and mechanical equipment shall operate quietly and free from vibration. Adjust, repair, balance, or replace equipment producing objectionable noise or vibration. Provide additional brackets or bracing that may be required to eliminate noise. All systems shall operate without

- humming, surging, or rapid cycling. All systems shall function as designed to meet specified requirements of the facility.
5. The Contractor's personnel or manufacturer's authorized representatives, when so specified, shall have completed instruction for LABORATORY's personnel in the proper operation and maintenance of systems, equipment and similar items as provided as part of the Work.
 6. All operating instructions for equipment shall be properly mounted and posted as specified.
- B. Inspection Procedures: Upon receipt of CONTRACTOR'S request, Laboratory will either proceed with inspection or advise the CONTRACTOR of prerequisites not fulfilled. Following initial inspection, Laboratory will acknowledge and confirm substantial completion, or will advise the CONTRACTOR of the work, in narrative and/or punchlist format, which must be performed prior to substantial completion. Laboratory will repeat the inspection only when requested and assured by the CONTRACTOR that Work has been substantially completed. The results of the Final Substantial Completion inspection will be transmitted by the Laboratory in the form of a narrative and/or punchlist for acceptance.

1.04 PREREQUISITES TO FINAL ACCEPTANCE

- A. General: Prior to requesting the Inspection and Acceptance Memorandum for final acceptance and final payment, as required by the Contract Documents, complete the following and list known exceptions (if any) in request:
1. Submit final payment request, final releases and supporting documentation as required in Appendix A.
 2. Submit written certification that: 1) the Work has been inspected by the Contractor for compliance with the Contract Documents, and 2) the Work has been completed in accordance with the Contract Documents.
 3. Submit copy of final punchlist of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
 4. Submit specific warranties, final certifications, all remaining submittals and all other document requirements.
 5. Submit project record documents, record specifications, final project photographs, and other record documents described in the Specifications.
 6. Deliver tools, spare parts, extra stocks of materials, and similar physical items to Laboratory.
 7. Complete final cleaning up requirements, including touch-up painting of marred surfaces.
 8. All closeout submittals listed in Article 1.05 herein shall be submitted to, and accepted by Laboratory.
- B. Final Inspection Procedure: Upon receipt of CONTRACTOR'S notice and request that the work has been completed, and excepting incomplete items delayed because of acceptable circumstances, Laboratory will inspect the work. Upon completion of final inspection, Laboratory will issue an Inspection and Acceptance Memorandum for the CONTRACTOR'S execution, or advise the CONTRACTOR of work not completed or obligations not fulfilled as required for final acceptance. If necessary, procedure will

be repeated. The CONTRACTOR'S executed Inspection and Acceptance Memorandum shall then be signed by the authorized Laboratory representatives and form the basis for Contract closeout.

1.05 CLOSEOUT SUBMITTALS

- A. Submit the following to Laboratory or Laboratory's Designated Representative, where directed.
 - 1. Operation and Maintenance Data for equipment so listed in other Sections of these Specifications, and for other items when so directed by Laboratory.
 - 2. Project Record Documents as specified in Specification Section 01720.
 - 3. Warranties and bonds for equipment and materials put into service.
 - 4. Keys and keying schedules.
 - 5. Tools, spare parts and maintenance materials. Contractor shall provide any special tools, jigs, fixtures and lifting tackle which are necessary for assembly, erection, operation, maintenance, and repair of equipment.
 - 6. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service, including nights, weekends, and holidays.
- B. Deliver evidence of compliance with requirements of governing authorities as required.
- C. Deliver certificate of insurance for products and completed operations.
- D. Submit Contractor's affidavit of payment of debts, and claims and release of liens duly executed before delivery to Laboratory or Laboratory's Designated Representative.
- E. Final adjustment of accounts:
 - 1. Submit a final statement of accounting to Laboratory or Laboratory's Designated Representative, showing adjustments to the Contract Sum.
 - 2. When required, Laboratory or Laboratory's Designated Representative will prepare a final Change Order showing adjustments to the Contract Sum which were not made previously by Change Orders.

END OF SECTION

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SECTION 01 71 00
CLEANING

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Keep premises, adjacent private properties and public properties free from accumulations of waste, debris and rubbish caused by construction operations.
2. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces. Leave Project clean and ready for occupancy.

1.02 SAFETY REQUIREMENTS

A. Standards: Maintain Project in accord with State and local safety and insurance standards.

B. Hazard control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.
2. Prevent accumulation of wastes which create hazardous conditions.
3. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on Project site.
2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains. Store in containers with tight-fitting lids and remove to legal dump site.

2.00 PRODUCTS

(Not applicable)

3.00 EXECUTION

3.01 DURING CONSTRUCTION

- A. Keep premises, adjacent properties and public properties free from accumulations of waste materials and rubbish. Remove debris and dirt from public property promptly; sweep sidewalks and adjacent streets daily when soiled by work performed under this Contract.
- B. Remove or paint over, as appropriate to the substrate, graffiti on the site or surrounding fence daily.
- C. Wet down materials and rubbish to lay dust and prevent it from blowing.
- D. At least once a day, or more often if required, clean site and dispose of waste materials, debris and rubbish off the site in a legal manner. Remove combustible materials such as paper and cardboard daily.
- E. Provide on-site containers for collection of waste materials, debris and rubbish. Provide a collection can at each location used as an eating area. Pick-up all garbage daily.
- F. Remove waste materials, debris and rubbish from site and legally dispose of at legal public or private dumping areas off Laboratory's property.
- G. Do not allow debris and combustible materials to accumulate in voids, cavities, and plenums created by wall, partition, and ceiling construction. These areas must be thoroughly cleaned out before being sealed or closed off by installation of finish materials.
- H. Vacuum clean interior areas when ready to be painted.
- I. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- J. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- K. Clean roof drains, scuppers, floor drains and area drains free of debris. Verify that they drain properly.

3.02 FINAL CLEANING

- A. Employ experienced workmen, or professional cleaners, for final cleaning.

- B. In preparation for Substantial Completion or Occupancy conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
- C. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed finished surfaces; polish bright surfaces to shine finish using caution not to scratch them. Broom clean floors not scheduled to receive a finish material or coating.
- D. Remove all glazing compound and sealant, markers, stains and paint from glass. Wash and polish glass to remove all stains and marks. Replace stained, broken, and scratched glass and leave in condition specified above.
- E. Repair, patch and touch-up marred surfaces to specified finish to match adjacent surfaces.
- F. Contaminated earth:
 - 1. Final clean-up operation includes the removal and disposal of earth contaminated or unsuitable for support of plant life in planting areas, and filling of resulting excavations with suitable soil.
 - 2. Contaminated areas include those used for disposal of waste concrete, mortar, plaster, masonry, and similar materials, areas in which washing out of concrete and plaster mixers or washing of tools and like cleaning operations have been performed, and areas that have been oiled, paved, or chemically treated.
 - 3. Do not dispose of waste oil, solvents, paints, solutions, or like penetrating material by depositing or burying on Laboratory's property.
- G. Broom clean paved surfaces; rake clean other surfaces of grounds.
- H. Keep Project clean until it is occupied by Laboratory.

END OF SECTION

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SECTION 01 72 00
PROJECT RECORD DOCUMENTS

1.0 GENERAL

1.1 MAINTENANCE OF DOCUMENTS

- A. Maintain at site, one copy of Project Manual and Drawings, Written Amendments and Change Orders to the Contract, Addenda, reviewed shop drawings, coordination drawings, bulletins, Field Orders and Requests for Information, other modifications to the Contract, and field test records.
- B. File Record Documents apart from construction documents and maintain in clean, dry, legible condition. Make Record Documents available for review by Laboratory or Laboratory's Designated Representative during regular business hours.
- C. Do not use Record Documents for construction purpose.
- D. Record Documents will be subject to a monthly review by Laboratory or Laboratory's Designated Representative prior to approval of each progress payment.

1.2 RECORDING

- A. Clearly label each document "PROJECT RECORD DOCUMENT".
- B. Keep Record Documents current.
- C. Do not permanently conceal any work until required information has been recorded.
- D. Record and properly dimension deviations on the record drawings within twenty four (24) hours after work in affected area is completed. Use a fine felt or nylon tip pen with waterproof colored ink for marking. Legibly mark to record actual constructions of the following.
 - 1. Depths of various elements of foundation in relation to First Floor Level.
 - 2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements. Cut-off points and point of connections of utilities.
 - 3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - 4. Field changes of dimension and detail.
 - 5. Changes made by Change Order, Field Order and Requests for Information.

6. Details not on original Contract Drawings.
- E. Legibly mark-up each Section of the Specifications to record the following.
 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment installed.
 2. Changes made by Change Order, Field Order and Request For Information.
 3. Other matters not originally specified.
 - F. Maintain shop drawings as Record Documents. Legibly annotate to record changes made after approval.

1.3 RECORD DRAWINGS

- A. At completion of project, submit to Laboratory or Laboratory's Designated Representative a set of updated electronic CAD files (in one of the latest two versions of AutoCad Software) and a bond set plot of files of all affected Contract and Shop Drawings.
- B. Incorporate on files and documents, all changes noted on record set in black ink. This requirement applies to all the disciplines. Work shall be performed by an experienced, competent draftsman. Identify documents as "RECORD DRAWINGS".

1.4 SUBMITTALS

- A. Deliver Record Documents, electronic files and documents to Laboratory or Laboratory's Designated Representative at completion of Project.
- B. Accompany submittal with transmittal letter, in duplicate, containing date, Project title and number, Contractor's name and address, title and number of each Record Document, certification that each document as submitted is complete and accurate, and signature of Contractor, or Contractor's authorized representative.

1.5 BIM MODEL

- A. Deliver finalized 3D BIM coordination model to Laboratory or Laboratory's Designated Representative at completion of Project.
- B. Accompany submittal with transmittal letter, in duplicate, containing date, Project title and number, Contractor's name and address, title and number of each Record Document, certification that each document as submitted is complete and accurate, and signature of Contractor, or Contractor's authorized representative.

END OF SECTION

SECTION 01 73 00
OPERATIONAL MANUALS

1.00 GENERAL

Coordinate the work of this Section with the requirements of Divisions 01 through 41.

1.01 DESCRIPTION

- A. Contractor shall provide Laboratory with manuals for the operation of the systems and equipment listed, but not limited to, in this Section.

1.02 SUBMITTAL

A. Manual Description

1. Bind manuals in durable plastic binders.
2. Use 8-1/2" x 11" sheets, except that larger sheets may be used when folded to this size and used as a pull-out.

B. Submittal

1. Format Submittal. The contractor shall submit eight copies of a preliminary draft of the proposed format and outline of contents of Operating Manuals one hundred eighty (180) days prior to commencement of Operational Training. Laboratory will require thirty (30) days for format review.
2. Preliminary Submittal. Eight draft copies of the draft manuals shall be submitted to Laboratory for review sixty (60) days prior to commencement of Operational Training. One copy will be returned to the contractor within thirty (30) days after submittal and, if required, shall be revised and resubmitted within thirty (30) days.
3. Final Submittal. Eight (8) complete sets of manuals shall be furnished to Laboratory prior to the commencement of Operational Training.

2.00 REQUIREMENTS

2.01 PURPOSE

- A. Operation manuals are for the training of, and use by, Laboratory employees in the operation of the systems and equipment as specified below. The manuals shall consist of instruction on systems and equipment. A separate manual or chapter shall be prepared for each of the following classes of equipment or system:
1. Sitework water supply and irrigation systems.
 2. Thermal and Moisture Protection
 3. Doors and Fenestration.

4. Finishes
5. Specialties
6. Equipment
7. Conveying Systems
8. Mechanical Systems
9. Electrical Systems

2.02 CONTENT

- A. Unless otherwise indicated, each chapter shall contain the following, as applicable, and in addition to other requirements specified in other Sections.
1. Introduction
 2. Table of contents
 3. Description of system (including design intent and considerations).

2.03 PREPARATION

- A. The outline below is intended as a general guide for preparing the manuals. The manuals shall be prepared to provide for the optimum operation of the various systems. Provide description of systems and general operating instructions. Manufacturer's literature and data shall be those of the actual equipment installed under contract for the particular facility. Clearly indicate the precise items included in this installation and delete, or otherwise clearly indicate all manufacturers' data with which this installation is not concerned.

2.04 SUGGESTED OUTLINE FOR OPERATION MANUALS

- A. Following this is a suggested outline, with general requirements of operation manuals. The outline is presented to indicate the extent of material to be covered and the individual items required in manuals for major facilities. The outline may be modified to suite specific installations. The manual is not intended to duplicate manufacturers' data, but proper references to manufacturer's data shall be made in the text of the operation manuals to indicate that information is current and applicable.

PART I Description and Design Intent

A. Introduction

1. Provide a brief description of project and purpose of the operation manual. The following statements shall be included: "Operation of this system and equipment shall be performed in accordance with this manual and posted instructions, subject to compliance with applicable technical guides and standards issued by Laboratory. It is recognized that minor changes in control points and settings will be required, based on actual operating experience, to correct varying conditions and improve operation. When such changes appear necessary, they shall be submitted to Laboratory for consideration. Upon approval of

any changes, the applicable portions of all copies of the manual and proposed instructions shall be revised and reissued, and any change in operating procedure brought to the attention of all operating personnel."

2. "This manual is specifically developed to assist Laboratory official in charge at the facility to operate the building systems and equipment. Manufacturers' recommendations set forth for certain components shall be followed during the complete warranty period for that equipment."
3. Contents of Manual. This portion of the introduction shall explain that the manual is presented in a number of columns that contain complete operating, and safety instructions for all equipment. It shall also contain any other appropriate references as required to outline an explanation of the manuals and major categories of reference material required with the manuals.

B. Table of Contents

1. The table of contents shall list numbers and titles of chapters, sections, and main paragraphs, with their page numbers. Reference to applicable specification divisions and section number shall be included. Each volume in a set of manuals shall contain its own table of contents. Publications containing ten (10) or more illustrations or tables shall include a list of illustrations or tables, as applicable. These lists shall show number, title, and page number of each illustration and table. Following is a typical table of contents (not necessarily representative of the ESB Project):

A. DIVISION 2 SITEWORK

1. Section 02660 Water Lines
2. Section 02665 Booster Pumps
3. Section 02810 Landscape Irrigation System

B. DIVISION 8 DOORS AND FENESTRATION

1. Section 08305 Access Panels
2. Section 08310 Vault Door and Frame
3. Section 08330 Rolling Doors
4. Section 08335 Rolling Counter Shutters
5. Section 08340 Rolling Grille
6. Section 08365 Telescoping Doors
7. Section 08460 Automatic Doors and Operators
8. Section 08465 Automatic Door Operators
9. Section 08520 Operable Steel Windows
10. Section 08700 Finish Hardware
11. Section 08800 Glass and Glazing
12. Section 08810 Security Glazing

C. DIVISION 10 SPECIALTIES

1. Section 10270 Access Flooring
2. Section 10350 Flagpoles
3. Section 10600 Movable Partitions
4. Section 10615 Relocatable Partitions
5. Section 10800 Toilet Room Accessories
6. Section 10990 Building Specialties

D. DIVISION 11 EQUIPMENT

1. Section 11010 Workshop Equipment
2. Section 11023 Pass-Thru Units
3. Section 11130 Projection Screens
4. Section 11140 Vehicle Service Equipment
5. Section 11155 Automatic Sliding Gate Assemblies
6. Section 11160 Loading Dock Equipment
7. Section 11400 Food Service Equipment
8. Section 11450 Residential Appliances
9. Section 11610 Laboratory Fume Hoods

E. DIVISION 14 CONVEYING SYSTEMS

1. Section 14200 Elevators

F. DIVISION 15 MECHANICAL SYSTEMS

1. Section 15010 Mechanical General Provisions
2. Section 15400 Plumbing System
3. Section 15500 Automatic Fire Sprinkler System
4. Section 15700 Steamfitting
6. Section 15800 Heating, Ventilating and Air Conditioning Systems
7. Section 15900 Controls and Instrumentation
9. Section 15950 TES Direct Digital Controls

G. DIVISION 16 ELECTRICAL SYSTEMS

1. Section 16000 Electrical Work
2. Section 16600 Low Voltage System
3. Section 16610 Fire Alarm System
4. Section 16615 Security Control System
5. Section 16620 Facility Intercom System
6. Section 16625 Intra-Communication System
7. Section 16627 Threshold Monitoring System
8. Section 16630 Paging System
9. Section 16632 Entertainment Television System
10. Section 16637 Auditorium Sound System
11. Section 16650 Video Surveillance System

12. Section 16655 Nurse Call System
13. Section 16670 Access/Monitoring System
14. Section 16675 Hands-Free Intercom System

PART II Operating Sequence and Procedures

- A. Contents. The operating manuals shall contain a chapter for each item included in Part I. Each chapter shall describe the procedures necessary for Laboratory personnel to operate the system and equipment covered in that chapter.
- B. Operating Procedures. The operating procedures shall be divided into four (4) subsections: Startup, Operation, Emergency Operation, and Shutdown.
 1. Startup. Give complete instructions for energizing the equipment and making initial settings and adjustments whenever applicable. If equipment is fully automatic, a statement to that effect is all that is required. If a specific sequence of steps shall be performed, give step-by-step instructions in the proper sequence. If timing (such as warm-up between power-on and adjustment) is important, clearly state the specific minimum time required at the proper point in the procedure. Refer to controls and indicators by panel; make references consistent with the nomenclature used in illustrations and tables of controls and indicators. If preliminary settings differ for different modes of operations, give procedures for each mode.
 2. Operation. Give detailed instruction in proper sequence for each mode of operation. When, for a given action on the part of the operator, alternate equipment responses are possible, give the appropriate operation reaction to each.
 3. Emergency Operation. If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under these conditions. Include here only those alternate methods of operation (from normal) that the operator can follow when there is a partial failure or malfunctioning of components, or other unusual condition.
 4. Shutdown. Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.

3.00 POSTED OPERATING INSTRUCTIONS AND TOOLS

3.01 POSTED OPERATING INSTRUCTIONS

- A. General. Operating instructions and diagrams shall be prepared for posting near the equipment at locations approved by Laboratory. Posted operating instructions shall be photographic or equal nonfading reproductions framed under glass or encased in

non-discoloring plastic and shall be mounted in locations as directed. Copies of the posted operating instructions shall also be used with the operating manuals as a basis for training Laboratory personnel in the operation of systems and equipment installed under contract at the facility.

- B. Posted operating instructions shall consist of simplified, consolidated equipment, control, and power diagrams graphically representing the entire system and actual equipment installed, including concise written instructions on how to start and stop systems, what settings and conditions are to be observed, and what control adjustments are to be made or maintained by the operation. Posted operating instructions shall include, but are not limited to the following:
1. Boiler and burner controls.
 2. Refrigeration controls.
 3. Heating, ventilating, and air-conditioning controls for each system.
 4. Controls for dust collection systems.
 5. One-line schematic diagrams of water supply (plumbing).
 6. One-line diagrams of steam distribution and hot water and chilled water systems, including risers, main shutoff valves, balancing cocks, and the like.
 7. One-line isometric diagrams of sanitary drainage.

3.02 TOOLS

- A. Contractor shall provide all the tools necessary for the operation of all the systems and equipment.

END OF SECTION

SECTION 01 73 50
MAINTENANCE MANUALS

1.00 GENERAL

Coordinate the work of this Section with the requirements of Divisions 01 through 41.

1.01 DESCRIPTION

- A. Contractor shall provide Laboratory with manuals for the maintenance of the systems and equipment listed, but not limited to, in this Section.

1.02 SUBMITTAL

A. Manual Description

1. Bind manuals in durable plastic binders.
2. Use 8-1/2" x 11" sheets, except that larger sheets may be used when folded to this size and used as a pull-out.

B. Submittal

1. Format Submittal. The Contractor shall submit eight (8) copies of a preliminary draft of the proposed format and outline of contents of Maintenance Manuals one hundred eighty (180) days prior to commencement of Operational Training. Laboratory will require thirty (30) days for format review.
2. Preliminary Submittal. Eight draft copies of the draft manuals shall be submitted to Laboratory for review sixty (60) days prior to commencement of Operational Training. One copy will be returned to the Contractor within thirty (30) days after submittal and, if required, shall be revised and resubmitted within thirty (30) days.
3. Final Submittal. Eight (8) complete sets of manuals shall be furnished to Laboratory prior to the commencement of Operational Training.

2.00 REQUIREMENTS

2.01 PURPOSE

- A. Maintenance manuals are for the training of, and use by, Laboratory employees in the maintenance of the systems and equipment as specified below. The manuals shall consist of instruction on systems and equipment. A separate manual or chapter shall be prepared for each of the following classes of equipment or system:
1. Sitework water supply and irrigation systems.
 2. Thermal and Moisture Protection

3. Doors and Fenestration.
4. Finishes
5. Specialties
6. Equipment
7. Conveying Systems
8. Mechanical Systems
9. Electrical Systems

2.02 CONTENT

- A. Unless otherwise indicated, each chapter shall contain the following, as applicable, and in addition to other requirements specified in other Sections.
 1. Introduction
 2. Table of contents
 3. Description of system (including design intent and considerations).

2.03 PREPARATION

- A. The outline below is intended as a general guide for preparing the manuals. The manuals shall be prepared to provide for the optimum maintenance of the various systems. Provide description of systems and general maintenance instructions. Manufacturer's literature and data shall be those of the actual equipment installed under contract for the particular facility. Clearly indicate the precise items included in this installation and delete, or otherwise clearly indicate all manufacturers' data with which this installation is not concerned.

2.04 SUGGESTED OUTLINE FOR MAINTENANCE MANUALS

- A. Following this is a suggested outline, with general requirements of maintenance manuals. The outline is presented to indicate the extent of material to be covered and the individual items required in manuals for major facilities. The outline may be modified to suit specific installations. The manual is not intended to duplicate manufacturers' data, but proper to manufacturers data references shall be made in the text of the maintenance manual to indicate that information is current and applicable.

PART I Description and Design Intent

- A. Introduction
 1. Provide a brief description of project and purpose of the maintenance manual. The following statements shall be included: "Maintenance of this system and equipment shall be performed in accordance with this manual and posted instructions, subject to compliance with applicable technical guides and standards issued by Laboratory. It is recognized that minor changes in control points and settings will be required, based on actual operating experience, to correct varying conditions

and improve operation. When such changes appear necessary, they shall be submitted to Laboratory for consideration. Upon approval of any changes, the applicable portions of all copies of the manual and proposed instructions shall be revised and reissued, and any change in operating procedure brought to the attention of all operating personnel."

2. "This manual is specifically developed to assist Laboratory official in charge at the facility to maintain the building systems and equipment. Manufacturers' recommendations set forth for certain components shall be followed during the complete warranty period for that equipment."
3. Contents of Manual. This portion of the introduction shall explain that the manual is presented in a number of columns that contain complete maintenance, and safety instructions for all equipment. It shall also contain any other appropriate references as required to outline an explanation of the manuals and major categories of reference material required with the manuals.

B. Table of Contents

1. The table of contents shall list numbers and titles of chapters, sections, and main paragraphs, with their page numbers. Reference to applicable specification divisions and section number shall be included. Each volume in a set of manuals shall contain its own table of contents. Publications containing ten (10) or more illustrations or tables shall include a list of illustrations or tables, as applicable. These lists shall show number, title, and page number of each illustration and table. Following is a typical table of contents (not necessarily representative of the ESB Project):

A. DIVISION 2 SITEWORK

1. Section 02660 Water Lines
2. Section 02665 Booster Pumps
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B. DIVISION 8 DOORS AND FENESTRATION

1. Section 08305 Access Panels
2. Section 08310 Vault Door and Frame
3. Section 08330 Rolling Doors
4. Section 08335 Rolling Counter Shutters
5. Section 08340 Rolling Grille
6. Section 08365 Telescoping Doors
7. Section 08460 Automatic Doors and Operators
8. Section 08465 Automatic Door Operators
9. Section 08520 Operable Steel Windows
10. Section 08700 Finish Hardware

- 11. Section 08800 Glass and Glazing
- 12. Section 08810 Security Glazing

C. DIVISION 9 FINISHES

- 1. Section 09900 Painting

D. DIVISION 10 SPECIALTIES

- 1. Section 10270 Access Flooring
- 2. Section 10350 Flagpoles
- 3. Section 10400 Identifying Devices
- 4. Section 10600 Movable Partitions
- 5. Section 10615 Relocatable Partitions
- 6. Section 10800 Toilet Room Accessories
- 7. Section 10990 Building Specialties

E. DIVISION 11 EQUIPMENT

- 1. Section 11010 Workshop Equipment
- 2. Section 11023 Pass-Thru Units
- 3. Section 11130 Projection Screens
- 4. Section 11140 Vehicle Service Equipment
- 5. Section 11155 Automatic Sliding Gate Assemblies
- 6. Section 11160 Loading Dock Equipment
- 7. Section 11400 Food Service Equipment
- 8. Section 11450 Residential Appliances
- 9. Section 11610 Laboratory Fume Hoods

F. DIVISION 14 CONVEYING SYSTEMS

- 1. Section 14200 Elevators

G. DIVISION 15 MECHANICAL SYSTEMS

- 1. Section 15010 Mechanical General Provisions
- 2. Section 15400 Plumbing System
- 3. Section 15500 Automatic Fire Sprinkler System
- 4. Section 15600 Halon Fire Protection System
- 5. Section 15700 Steamfitting
- 6. Section 15800 Heating, Ventilating and Air Conditioning Systems
- 7. Section 15850 Central Chilled Water Plant and Thermal Energy Storage
- 8. Section 15900 Controls and Instrumentation
- 9. Section 15950 TES Direct Digital Controls

H. DIVISION 16 ELECTRICAL SYSTEMS

- 1. Section 16000 Electrical Work

2. Section 16600 Low Voltage System
3. Section 16610 Fire Alarm System
4. Section 16615 Security Control System
5. Section 16620 Facility Intercom System
6. Section 16625 Intra-Communication System
7. Section 16627 Threshold Monitoring System
8. Section 16630 Paging System
9. Section 16632 Entertainment Television System
10. Section 16637 Auditorium Sound System
11. Section 16650 Video Surveillance System
12. Section 16670 Access/Monitoring System

PART II Maintenance Instructions and Requirements

- A. Contents. The maintenance manuals shall contain a chapter for each item included in Part I. Each chapter shall describe the procedures necessary for Laboratory personnel to perform the maintenance on the systems and equipment covered in that chapter. Emphasis shall be placed on the method of mechanical control of systems and equipment from a maintenance standpoint. References shall be made, as appropriate, to drawings, schematics, and sequences of operation included as part of the construction contract drawings and specifications that show piping and equipment arrangements and items of control. Prints of these drawings shall be reduced for insertion in the manuals, to 8-1/2" x 11" sheets, except that larger sheets may be used when folded to this size and used as a pull out. Drawings shall represent the "as-built" condition.
- B. Maintenance Procedures. The maintenance procedures shall be divided into two categories: Preventive Maintenance and Corrective Maintenance.
 1. Preventive Maintenance
 - a) Provide a schedule for preventive maintenance. State, preferably in tabular form, the recommended frequency of performance for each preventive maintenance task (cleaning, inspection, and scheduled overhauls).
 - b) Provide instruction and schedules for all routine maintenance cleaning and inspection, with recommended lubricants where applicable.
 - c) If periodic inspection of equipment is required for operation, cleaning, or other reasons, indicate the items to be inspected and give the inspection criteria for, but not limited to, the following:
 1. Motors
 2. Controls
 3. Filters
 4. Heat exchangers

- d) Provide instruction for minor repairs or adjustments required for preventive maintenance routines. Minor repair and adjustment shall be limited to repairs and adjustments that may be performed without special tools or test equipment and that require no special training or skills. Identify test points and give values for each.

2. Corrective Maintenance

- a) **Corrective Maintenance.** Corrective maintenance instructions shall be predicated upon a logical effect-to-cause troubleshooting philosophy and a rapid replacement procedure to minimize equipment downtime. Instructions and data shall appear in the normal sequence of corrective maintenance, for example, troubleshooting first, repair and replacement of parts second, and then the parts list.
- b) **Troubleshooting.** This information shall describe the general procedure for locating malfunctions and shall give, in detail, any specific remedial procedures or techniques. The data shown are intended to isolate only the most common equipment deficiencies. Troubleshooting tables, charts, or diagrams may be used to present specific procedures. A guide to this type shall be a three-column chart. The columns shall be entitled Malfunction, Probable Cause, and Recommended Action. The information shall be alphabetically arranged by component, and each component shall, in turn, list deficiencies that may be expected. Each deficiency shall contain one or more problems with a recommended correction.
- c) **Repair and Replacement.** Indicate the repair and replacement procedures most likely to be required in the maintenance of the systems and equipment. Information included here shall consist of step-by-step instructions for repair and replacement of defective items. Include all information required to accomplish repair or replacement, including information such as torque values. Identify all tools, special equipment, and materials that may be required. Identify uses for maintenance equipment. The paragraphs shall contain headings to identify the topics covered.
- d) **Safety Precautions.** This subsection shall comprise a listing of safety precautions and instructions to be followed before, during, and after repairs or adjustments are made or routine maintenance is performed.

- C. **Manufacturers' Brochures.** Include manufacturers' descriptive literature covering materials and devices used in the systems. Illustrations, exploded

views, and renewal parts lists where applicable shall be included. This Section shall also include special devices manufactured by the Electrical Contractor.

- D. Special Maintenance. Provide information of a maintenance nature covering warranty items that have not been discussed elsewhere.
- E. Shop Drawings. Provide a copy of all approved shop drawings covering approval of equipment for the project with the manufacturers' brochures. Include all data concerning changes made during construction.
- F. Spare Parts Lists. Include a recommended spare parts list for all equipment furnished for the project. The parts list shall include a tabulation of descriptive data for all the electrical electronic spare parts and all the mechanical spare parts proposed for each type of equipment or system. Each part shall be properly identified by part number and manufacturer.
- G. Guaranty and Warranty. Provide copy of guarantees and warranties issued by the equipment manufacturers.
- H. Locations of items and materials to be maintained or replaced shall be included. This particularly applies but is not limited to, access panels, glass and glazing, security glazing, painting, graffiti-resistant coating and other materials that are not easily identifiable as to exact type.

3.00 TOOLS

- A. Contractor shall provide all the tools necessary for the maintenance of all the systems and equipment.

END OF SECTION

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SECTION 01 74 00
WARRANTIES

1.00 GENERAL

1.01 DESCRIPTION

- A. Compile specified warranties and specified service and maintenance contracts.
- B. Review submittals to verify compliance with Contract Documents.
- C. Submit to Laboratory or Laboratory's Designated Representative as specified in Specification Section 01 70 00.

1.02 SUBMITTAL REQUIREMENTS

- A. Assemble warranties and service and maintenance contracts executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Submit two (2) original signed copies.
- C. Furnish a typed Table of Contents, in orderly sequence, with the following complete information for each item:
 - 1. Product or assembly.
 - 2. Firm, with name of principal, address and telephone number.
 - 3. Scope.
 - 4. Date of beginning of warranty or service and maintenance contract.
 - 5. Duration of warranty or service maintenance contract.
 - 6. Provide information for proper procedure to be followed in case of failure, and in instances which may affect the validity of warranty.
 - 7. Name of responsible principal of Contractor, and address and telephone number.

1.03 FORM OF SUBMITTALS

- A. Prepare and bind in a 3-ring binder of commercial quality, with durable and cleanable plastic covers. Label binding edge of binder with project name, location, project specification number and contents.
- B. Format:
 - 1. Size: 8-1/2" x 11"; punch sheets for standard 3-ring binder. Fold larger sheets to fit into binders.

2. Cover: Identify binder with typed or printed title "WARRANTIES," title of Project and Contractor's name.

1.04 TIME OF SUBMITTALS

- A. For equipment or component parts of equipment put into service during construction: Submit documents within ten (10) days after inspection and acceptance. Otherwise, make submittals as specified in Specification Section 01 70 00.
- B. For items whose acceptance is delayed materially beyond date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing date of acceptance as start of warranty period.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Laboratory has established that this Project shall include proactive measures for waste management participation by all parties to the contract.
 - 1. The purpose of this program is to ensure that during the course of the Project all diligent means are employed to pursue practical and economically feasible waste management and recycling options.
 - 2. Upon award, each subcontractor shall be required to furnish documentation from suppliers or manufacturers regarding waste management and recycling options for those products and procedures furnished.
 - 3. Waste disposal to landfills shall be minimized.
- B. Definitions:
 - 1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable construction materials that would otherwise be discarded or destroyed.
 - 2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris and trash resulting from construction operations.
 - 3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
 - 4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
 - 5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
 - 6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.
 - 7. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.
 - 8. Trash: Any product or material unable to be returned, reused, recycled or salvaged.
 - 9. Landfill: Any public or private business involved in the practice of trash disposal.
 - 10. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of a minimum of 75 percent by weight of total waste generated by the Work.
- B. Salvage/Recycle: Laboratory's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:

1.3 SUBMITTALS

- A. Project Information:
 - 1. Construction Waste Management Plan.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include separate report for demolition and construction waste. Include the following information:

1. Material category.
 2. Total quantity of waste in tons.
 3. Quantity of waste salvaged, both estimated and actual in tons.
 4. Quantity of waste recycled, both estimated and actual in tons.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit copies of calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. LEED Submittal: LEED letter template for Credit MR 2.1 and 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- I. Qualification Data: For refrigerant recovery technician.
- J. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.4 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Environmental Project Manager shall conduct conference at Project site to review methods and procedures related to waste management including but not limited to, the following:
1. Review and discuss Waste Management Plan.
 2. Review requirements for documenting quantities of each type of waste and its disposition.
 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 5. Review waste management requirements for each trade.

1.5 CONSTRUCTION WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, land-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone number.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Assign recycling to recycling subcontractor, or list local receivers and processors, and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility. List hazardous material waste and disposal separately.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Waste Management Plan shall include locations of sorting and waste storage facilities on Site Plan of project.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Implement waste management plan as approved by Laboratory. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract. Comply with the following procedures:
 - 1. Define specific areas to facilitate separation of materials for recycling, salvage, reuse or return.
 - 2. Separate construction waste by type at Project site to the maximum extent practical.
 - 3. Recycle and waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials. Inspect containers and bins weekly for contamination and remove contaminated materials if found.
 - 4. Do not mix recyclable materials.
 - 5. Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 6. Store materials away from construction area. Do not store within drip line of remaining trees.
 - 7. Store components off the ground and protect from weather.
 - 8. Remove construction waste off Laboratory's property and transport to appropriate receiver or processor.
- B. Hazardous Wastes: Store in secure areas and comply with the following:
 - 1. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:
 - a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
 - b. Disposal of fluorescent tubes to open containers is not permitted.
- C. Unused fertilizers shall not be co-mingled with construction waste.

- D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within seven days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.
- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with environmental controls specified in Division 01 Section 01 50 00 Temporary Facilities, Construction Controls and Facilities.
- F. Submit "Waste Reduction Progress Reports" each month as part of Application For Payment.
 - a. Materials identified in the Report shall be reported by weight.
 - b. Where weight is not applicable, Contractor shall report materials by units applicable to material recipient.
 - c. Procure receipts or other validation of waste management procedures and include them as part of the submittal.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
 - 1. Clean Salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Laboratory's Use:
 - 1. Clean Salvaged items.
 - 2. Pack or create items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Laboratory.
 - 4. Transport items to Laboratory's storage area [on-site] [off-site] [designated by Laboratory].
 - 5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill for incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials on site.
- C. Disposal: Transport waste materials off Laboratory's property and legally dispose of them.

END OF SECTION

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SECTION 01 81 21

INDOOR AIR QUALITY MANAGEMENT (IAQ) DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out.

1.2 DESCRIPTION, GENERAL

- A. IAQ Management During Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:
 - 1. Practices which minimize the amount of dust generated.
 - 2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.
 - 3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.
 - 4. No visible haze in the air.

1.3 SUBMITTALS

- A. Project Information:
 - 1. Construction IAQ Management Plan.
- B. LEED Information:
 - 1. LEED Credit EQ 3.1, Construction IAQ Management Plan During Construction:
 - 2. Construction IAQ Management Plan.
 - 3. Detailed photo log of implemented IAQ practices

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT

- A. Construction IAQ Management Plan. General IAQ Plan requirements during construction shall include:
 - 1. Compliance with "SMACNA Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3)."
 - 2. Provide solid physical barriers to isolate areas of construction. Securely attach and seal at floor and structure above.
 - 3. Schedule adequate time for product installation.
 - 4. Maintain negative pressure in construction area.
 - 5. Do not recirculate air prior to occupancy.
 - 6. Seal return air ducts and use direct exhaust to outside.
 - 7. Factory age sheet goods.
 - 8. Comply with manufacturer's instructions for appropriate drying times.
 - 9. Protect installed absorbent materials with recycled or recyclable materials.
- B. The IAQ Plan shall meet or exceed the five SMACNA requirements and shall include the following measures:
 - 1. HVAC Protection.

2. Source Control.
 3. Pathway Interruption.
 4. Housekeeping.
 5. Scheduling.
- C. HVAC Protection:
1. Protect air handling and distribution equipment, and air supply and return ducting during construction.
 2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.
 3. Apply protection immediately after installation of equipment and ducting.
 4. Ducting runs that require more than a single day to install shall be protected at the end of each day's Work.
 5. During dust producing activities, (e.g., drywall installation and finishing), turn the ventilation system off, and protect HVAC supply and return openings from dust infiltration. Provide temporary ventilation as required.
 6. If permanently installed air handlers are used during construction, temporary filtration media with minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2, latest edition. Remove temporary filtration media and replace all filtration media immediately prior to occupancy.
- D. Source Control:
1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.
 2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.
 3. Preconditioning:
 - a. Prior to delivery to the construction site allow products that have odors and significant volatile organic compound (VOC) emissions to off-gas in dry, well ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions.
 - b. Condition products, without containers and packaging, to maximize off-gassing of VOCs.
 - c. Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period.
 - d. Do not ventilate within limits of Work unless otherwise accepted by Architect.
 - e. Comply with substitution requirements for consideration of other locations.
 4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.
 5. Replace moldy materials with new, undamaged materials.
 6. Provide sufficient ventilation, air circulation and air changes to dissipate excess humidity when present.
- E. Pathway Interruption:
1. All openings within the designated work area shall be sealed.
 2. Adequate exhaust ventilation equipment shall be installed to maintain a negative pressure differential between the work area and adjacent areas of the building.
 3. Ventilation units shall be exhausted to the outside of the building.
- F. Housekeeping:
1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.
 2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:

- a. Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is stated in these Specifications, a period of 72 hours shall be used.
 - b. Ventilate areas directly to outside, do not ventilate to other enclosed spaces.
 - c. If continuous ventilation is not possible via the building's HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.
3. Suppress dust with wetting agents or sweeping compounds.
 4. Clean-up dust using a wet rag or damp mop.
 5. Increase the cleaning frequency when dust build-up is noted.
 6. Remove spills or excess applications of solvent-containing products as soon as possible.
 7. Remove accumulated water and keep work areas as dry as possible.
 8. Store volatile liquid containers closed when the container is inside of the building and not in use.
 9. Keep volatile liquid containers closed when the container is inside of the building and not in use.
- G. Scheduling:
1. Where odorous and/or high VOC-emitting products are applied on site, apply them before installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.
 2. Insure that wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are properly and fully cured before installing other finish materials over them.
 3. Install carpets and furnishings after all other interior finish materials have been applied and fully cured.
 4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.
 5. Complete interior finish material installation no less than 14 days prior to Substantial Completion to allow for building flush-out and testing prior to occupancy.

END OF SECTION

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SECTION 01 81 22
INDOOR AIR QUALITY PROTECTION BEFORE OCCUPANCY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing building flushout procedures.

1.2 DESCRIPTION, GENERAL

- A. Minimize indoor pollutant concentrations to required levels prior to occupancy by building flush out and/or baseline testing of targeted pollutants.

1.3 SUBMITTALS

- A. LEED Information:
 - 1. Submit narrative from responsible parties indicating that building flush out procedures were satisfactorily executed.
- B. Closeout Submittals:
 - 1. Submit testing laboratories report indicating that Baseline Indoor Air Testing has been satisfactorily completed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 BUILDING FLUSHOUT

- A. Contractor to propose one of the options below to the Laboratory for approval:
- B. LEED Credit EQ 3.2, Construction IAQ Management Plan, Before Occupancy - Flushout:
 - 1. Option 1:
 - a. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity of no higher than 60 percent.
 - 2. Option 2:
 - a. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. Ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

3.2 BASELINE IAQ TESTING

- A. LEED Credit EQ 3.2, Construction IAQ Management Plan, Before Occupancy - Baseline IAQ Testing:
 - 1. Air Quality Testing:

- a. Conduct baseline indoor air quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED Reference Guide."
- b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - 1) Formaldehyde: 50 ppb.
 - 2) Particulates (PM10): 50 micrograms/cu. m.
 - 3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
 - 4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
 - 5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
- c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
- d. Air sample testing shall be conducted as follows:
 - 1) All measurements shall be conducted prior to occupancy but during normal occupied hours and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
 - 2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
 - 3) Number of sampling locations will vary depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
 - 4) Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four hour period.

END OF SECTION

SECTION 01 91 00
COMMISSIONING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Coordination
- C. Commissioning Process
- D. Related Work
- E. Responsibilities
- F. Definitions
- G. Systems to be Commissioned
- H. Test Equipment
- I. Meetings
- J. Reporting
- K. Submittals
- L. Startup, Prefunctional Checklists and Initial Checkout
- M. Functional Performance Testing
- N. Documentation, Non-Conformance and Approval of Tests
- O. Operation and Maintenance (O & M) Manuals
- P. Training of Owner Personnel
- Q. Deferred Testing
- R. Written Work Products

1.2 DESCRIPTION

- A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.
- B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
 - 1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - 2. Verify and document proper performance of equipment and systems.
 - 3. Verify that O&M documentation left on site is complete.
 - 4. Verify that the Owner's operating personnel are adequately trained.
- C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.
- D. Abbreviations. The following are common abbreviations used in the *Specifications* and in the *Commissioning Plan*.

A/E	Architect and Design Engineers	GC	General Contractor (prime)
CA	Commissioning Authority	MC	Mechanical Contractor
CC	Controls Contractor	PC	Prefunctional Checklist
Cx	Commissioning	PM	Project Manager (of the Owner)
Cx Plan	Commissioning Plan Document	Subs	Subcontractors to General

EC	Electrical Contractor	TAB	Test and Balance Contractor
FPT	Functional Performance Test		

1.3 COORDINATION

- A. Commissioning Team. The members of the commissioning team consist of the Commissioning authority (CA), the Project Manager (PM), the General Contractor (GC or Contractor), the Architect and Design Engineers, the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner’s building or plant Operator/Engineer is also a member of the commissioning team.
- B. Scheduling. The CA will work with the GC to establish protocols to schedule the commissioning activities. The CA will provide sufficient notice to the GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
1. The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The *Commissioning Plan—Construction Phase* provides a format for this schedule. As construction progresses, more detailed schedules are developed by the CA. The Commissioning Plan also provides a format for detailed schedules.

1.4 COMMISSIONING PROCESS

- A. Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. The CA will issue a preliminary Cx Plan, prior to the initial commissioning scoping meeting. After the initial commissioning scoping meeting, the CA will update the plan, which is then considered the “final” plan, though it will continue to evolve and expand as the project progresses. The *Specifications* will take precedence over the *Commissioning Plan*.
- B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
 2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 3. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.
 4. The CA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with prefunctional checklists to be completed, during the startup process.
 5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.
 6. The Subs, under their own direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and

startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.

7. The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.
8. The procedures are executed by the Subs, under the direction of, and documented by the CA.
9. Items of non-compliance in material, installation or setup are corrected at the Subs' expense and the system retested.
10. The CA reviews the O&M documentation for completeness.
11. The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that it was completed.
12. Deferred testing is conducted, as specified or required.

1.5 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section.
 1. Section 20 05 00 – Mechanical General: Alerts the mechanical contractor to Cx responsibilities in 22 90 00 and 23 90 00.
 2. Section 22 90 00 and 23 90 00 – Mechanical Cx: Describes the Cx responsibilities of the mechanical, controls and TAB contractors, and the prefunctional testing and startup responsibilities of each.
 3. Section 26 00 10 – Electrical General: Alerts the Electrical Contractor of Cx responsibilities in 26 90 00.
 4. Section 26 90 00 – Electrical Cx: Describes the Cx responsibilities of the Electrical Contractor.

1.6 RESPONSIBILITIES

- A. The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the Mechanical Contractor, TAB and Controls Contractor are in Division 22 and 23, and those of the Electrical Contractor in Division 26. It is noted that the services for the Project Manager, Architect, Mechanical and Electrical Engineers, and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.
- B. All Parties:
 1. Follow the Commissioning Plan.
 2. Attend commissioning scoping meeting and additional meetings, as necessary.
- C. Architect:
 1. Manage the CA contract.
 2. Attend the commissioning scoping meeting and selected commissioning team meetings.
 3. Perform normal submittal review, construction observation, record drawing preparation, O&M manual preparation, etc., as contracted.

4. Provide any design narrative documentation requested by the CA.
5. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
6. Review and approve the O&M manuals.

D. Mechanical and Electrical Engineers:

1. Perform normal submittal review, construction observation, record drawing preparation, etc., as contracted.
2. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
3. Attend commissioning scoping meetings and other selected commissioning team meetings.
4. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Review and approve the O&M manuals.

E. Commissioning Authority (CA):

1. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the design intent and in accordance with the Contract Documents. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor and the A/E. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems.
2. Construction and Acceptance Phase:
 - a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
 - b. Coordinate the commissioning work and with the GC to ensure that commissioning activities are being scheduled into the master schedule.
 - c. Develop a *Commissioning Plan*.
 - d. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
 - e. Request and review additional information required to perform commissioning tasks, including O&M materials, Contractor start-up and checkout procedures.
 - f. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
 - g. Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
 - h. Write and distribute prefunctional tests and checklists.
 - i. Develop an enhanced start-up and initial systems checkout plan with Subs.
 - j. Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
 - k. Approve systems startup by reviewing start-up reports and by selected site observation.

- l. Witness air and water systems balancing by spot checking after reviewing completed reports.
- m. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending or manual functional testing.
- n. Analyze any functional performance trend logs and monitoring data to verify performance.
- o. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved. Witness performance of functional test procedures, executed by the contractors.
- p. Maintain a master deficiency and resolution log and a separate testing record.
- q. Oversee and approve the training of the Owner's operating personnel.
- r. Compile and maintain a commissioning record and building systems book(s).
- s. Review and approve the preparation of the O&M manuals.
- t. Provide a final commissioning report.

3. Warranty Period:

- a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
- b. Return to the site at 10 months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract.

F. Owner's Project Manager (PM):

1. Construction and Acceptance Phase:

- a. Manage the contract of the A/E and of the GC.
- b. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan*.
- c. Provide final approval for the completion of the commissioning work.

2. Warranty Period

- a. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

G. General Contractor (GC):

1. Construction and Acceptance Phase:

- a. Facilitate the coordination of the commissioning work by the CA and ensure that commissioning activities are being scheduled into the master schedule.
- b. Include the cost of commissioning in the total contract price.
- c. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
- d. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.

- e. When necessary, observe and witness prefunctional checklists, startup and functional testing of selected equipment.
- f. Review commissioning progress and deficiency reports.
- g. Coordinate the resolution of non-compliance identified in all phases of commissioning. The General Contractor shall withhold payments to subcontractors as required to ensure that all deficiencies are corrected.
- h. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
- i. Coordinate the training of Owner personnel.
- j. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

2. Warranty Period:

- a. Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
- b. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

H. Equipment Suppliers:

- 1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
- 2. Assist in equipment testing per agreements with Subs.
- 3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor.
- 4. Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest, most updated equipment reasonable for this project's scope and budget.
- 5. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
- 6. Review test procedures for equipment installed by factory representatives.

1.7 DEFINITIONS

- A. Acceptance Phase - Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.
- B. Approval - Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
- C. Architect/Engineer (A/E) - The prime consultant (Architect) and sub-consultants who comprise the design team, generally the Mechanical Engineer and the Electrical Engineer.
- D. Basis of Design - The basis of design is the primary thought processes and assumptions behind design decisions that were made to meet the design intent.

- E. Commissioning Authority (CA) - The CA directs and coordinates the day-to-day commissioning activities.
- F. Commissioning Plan - An overall plan, developed after bidding, that provides the structure, schedule and coordination planning for the commissioning process.
- G. Contract Documents - The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).
- H. Contractor - The General Contractor or authorized representative.
- I. Control system - The central building energy management control system.
- J. Deferred Functional Tests - FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
- K. Deficiency - A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
- L. Factory Testing - Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.
- M. Functional Performance Test (FT) - Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TABs primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.
- N. General Contractor (GC) - The Prime Contractor for this project. Generally refers to all the GC's subcontractors as well. Also referred to as the Contractor, in some contexts.
- O. Indirect Indicators - Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.
- P. Manual Test - Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- Q. Monitoring - The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.
- R. Non-Compliance - see Deficiency.
- S. Non-Conformance - see Deficiency.

- T. Over-written Value - Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50°F to 75°F to verify economizer operation). See also “Simulated Signal.”
- U. Prefunctional Checklist (PC) - A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer’s start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.
- V. Project Manager (PM) - The contracting and managing authority for the Owner over the design and/or construction of the project; a staff position.
- W. Sampling - Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
- X. Seasonal Performance Tests - FT that are deferred until the system(s) will experience conditions closer to their design conditions.
- Y. Simulated Condition - Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- Z. Simulated Signal - Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
- AA. Specifications - The construction specifications of the Contract Documents.
- BB. Startup - The initial starting or activating of dynamic equipment, including executing prefunctional checklists.
- CC. Subs - The subcontractors to the GC who provide and install building components and systems.
- DD. Test Procedures - The step-by-step process that must be executed to fulfill the test requirements. The test procedures are developed by the CA.
- EE. Test Requirements - Requirements specifying what modes and functions, etc., shall be tested. The test requirements are not the detailed test procedures.
- FF. Trending - Monitoring using the building control system.
- GG. Vendor - Supplier of equipment.
- HH. Warranty Period - Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.8 SYSTEMS TO BE COMMISSIONED

- A. The following systems will be commissioned in this project.
 - 1. Mechanical Systems:
 - a. Air handling units
 - b. Steam system (including condensate pumps)
 - c. Hot water system (including pumps and generators)
 - d. Chilled water system
 - e. Heat recovery systems
 - f. Clean steam system
 - g. Humidifiers
 - h. Blower coils
 - i. Fan coils
 - j. Duct mounted reheat coils
 - k. Exhaust fans
 - l. Computer Room air conditioning units
 - m. Pumps
 - n. VAV boxes
 - o. Lab air valve pressure controls / fume hood exhaust
 - p. Fire / smoke dampers
 - q. Unit heaters
 - r. Testing, adjusting, and balancing work
 - s. Booster pumps
 - t. Sump pumps
 - u. Building automation system
 - v. Variable speed drives
 - 2. Plumbing Systems:
 - a. Domestic Hot Water System
 - 3. Electrical Systems:
 - a. Switchboards
 - b. Generator and generator controls
 - c. Automatic transfer switches
 - d. Power monitors
 - e. Life / Safety interface
 - f. Lighting controls, including daylighting controls
 - 4. Special Systems:
 - a. Security Access

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout, and required functional performance testing shall be provided by the Division Contractor for the equipment being tested. For example, the Mechanical Contractor of Division 22 and 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in

Division 22 and 23, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the respective Division 22 and 23 or 26 Subcontractor.

- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the base bid price to the Contractor and left on site.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the *Specifications*. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Scoping Meeting. The CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA.
- B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs. Meetings may be held monthly, until the final three months of construction, when they may be held as frequently as one per week.

3.2 REPORTING

- A. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
- B. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

3.3 SUBMITTALS

- A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At a minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of Owner-contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.
- B. The Commissioning Authority will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This

review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications.

- C. The CA may request additional design narrative from the Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.
- D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and startup.
- B. General. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
- C. Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms.
 - 1. These checklists and tests are provided by the CA to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
 - 2. The Subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CAs checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
 - a. The full start-up plan could consist of something as simple as:
 - 1) The CAs prefunctional checklists.
 - 2) The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - 3) The manufacturer's normally used field checkout sheets.
 - 3. The Subcontractor submits the full startup plan to the CA for review and approval.
 - 4. The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.

D. Sensor and Actuator Calibration:

1. All field-installed temperature, relative humidity, CO, CO₂ and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner beforehand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed *in* the unit at the factory with calibration certification provided, need not be field calibrated.
2. All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

E. Sensor Calibration Methods:

1. All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.
2. Sensors Without Transmitters - Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
3. Sensors With Transmitters - Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

Tolerances, Standard Applications

Sensor	Required Tolerance (\pm)	Sensor	Required Tolerance (\pm)
Condenser water temps	0.4°F	Flow rates, water	4% of design
WSHP wet bulb or dew point	2.0°F	Relative humidity	4% of design
Outside air, space air, duct air temps	0.4°F	Barometric pressure	0.1 in. of Hg
Watt hour, voltage & amperage	1% of design		
Pressures, air, water and gas	3% of design		
Flow rates, air	10% of design		

F. Valve and Damper Stroke Setup and Check:

1. EMS Readout. For all valve and damper actuator positions checked, verify the actual position against the BAS readout.
2. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
3. Closure of Isolation Control Valves (NC): Command the valve closed. Observe the valve close. Remove power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Command the valve open. Observe valve open. Restore to normal.
4. Closure of Isolation Control Valves (NO): Command the valve open. Observe the valve open. Remove power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Command the valve closed. Observe valve closed. Restore to normal.

G. Execution of Prefunctional Checklists and Startup:

1. Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the GC and CA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.
2. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
3. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

H. Deficiencies, Non-Conformance and Approval in Checklists and Startup:

1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.
2. The CA reviews the report for approval. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the GC and

others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the GC.

3.5 FUNCTIONAL PERFORMANCE TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.
- B. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
1. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc., shall also be tested.
- C. Development of Test Procedures. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points lists, program code, control sequences and parameters. The CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection.
1. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.
 2. Representative test formats and examples (not designed for this facility) are found at the end of Sections 22 90 00, 23 90 00 and 26 90 00. The test procedure forms developed by the CA shall include (but not be limited to) the following information:
 3. System and equipment or component name(s)
 4. Equipment location and ID number
 5. Unique test ID number and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment
 6. Date
 7. Project name
 8. Participating parties
 9. A copy of the specification section describing the test requirements
 10. A copy of the specific sequence of operations or other specified parameters being verified
 11. Formulas used in any calculations
 12. Required pre-test field measurements
 13. Instructions for setting up the test.
 14. Special cautions, alarm limits, etc.
 15. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
 16. Acceptance criteria of proper performance with a Yes/No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
 17. A section for comments
 18. Signatures and date block for the CA

D. Testing Requirements:

1. To facilitate field testing, the controls contractor must be able to provide functional access to the control system via the graphical user interface from a laptop. The laptop will be operated by the controls contractor, and should be able to roam throughout the project site while maintaining connectivity. Coordination with the building wired or wireless network, or the provision of temporary wireless access points, will be required. The intent of this requirement is for the controls contractor to be proximate to equipment being tested.

E. Test Methods:

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
4. Simulated Signals. Using a signal generator that creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
5. Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout setpoint to be 2°F above the current outside air temperature.
6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
7. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc., to produce the necessary flows, pressures, temperatures, etc., necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

8. Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference alone does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.
 - a. A common sampling strategy referenced in the *Specifications* as the “xx% Sampling—yy% Failure Rule” is defined by the following example.
 - b. xx = the percent of the group of identical equipment to be included in each sample.
 - c. yy = the percent of the sample that if failing, will require another sample to be tested.

9. The example below describes a 10% Sampling—10% Failure Rule.
 - a. Randomly test at least 10% (xx) of each group of identical equipment. In no case test less than three units in each group. This 10%, or three, constitute the “first sample.”
 - b. If 10% (yy) of the units in the first sample fail the functional performance tests, test another 10% of the group (the second sample).
 - c. If 10% of the units in the second sample fail, test all remaining units in the whole group.
 - d. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units prior to continuing with functionally testing the remaining units.

F. Coordination and Scheduling. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the CM, GC and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

1. In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC and Subs for review. The CA will include the filled out forms in the O&M manuals.

- B. Non-Conformance:
 1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported on a standard non-compliance form.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases, the deficiency and resolution will be documented on the procedure form.
 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
 4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
 - a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
 - 1) The CA documents the deficiency and the Subs' response and intentions and they go on to another test or sequence. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
 - 2) The CA reschedules the test and the test is repeated.
 - b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the GC and to the Sub representative assumed to be responsible.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.
 - 3) The CA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.
 5. The Contractor shall respond in writing to the CA and GC at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
 6. The CA retains the original non-conformance forms until the end of the project.
- C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the GC or PM. In such case, the Contractor shall provide the Owner with the following:
1. Within one week of notification from the GC or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the GC or PM within two weeks of the original notice.

2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The GC or PM will determine whether a replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution will be installed by the Contractor and the GC will be allowed to test the installations for up to one week, upon which the GC or PM will decide whether to accept the solution.
5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval. The CA notes each satisfactorily demonstrated function on the test form.

3.7 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals:

1. The specific content and format requirements for the standard O&M manuals are detailed in Section 01 70 00.
2. CA Review and Approval. Prior to substantial completion, the CA shall review the O&M manuals, documentation and redline as-builts *for systems that were commissioned* and to verify compliance with the *Specifications*. The CA will communicate deficiencies in the manuals to the GC, PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the GC, PM or A/E. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated.

3.8 TRAINING OF OWNER PERSONNEL

- A. The GC shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed.
- B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment or systems.
 1. The CA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Subs and vendors who have training responsibilities.
 2. In addition to these general requirements, the specific training requirements of Owner personnel by Subs and vendors is specified in Divisions 22 and 23 and 26.

3. Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:
 - a. Equipment (included in training)
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subjects covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - i. Instructor and qualifications
4. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
5. The CA develops an overall training plan and coordinates and schedules with the GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc.
6. Videotaping of the training sessions may be provided by the Owner.

3.9 DEFERRED TESTING

- A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.
- B. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.10 WRITTEN WORK PRODUCTS

- A. The commissioning process generates a number of written work products described in various parts of the *Specifications*. The *Commissioning Plan*, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

<u>Product</u>	<u>Developed By</u>
1. Final commissioning plan	CA
2. Meeting minutes	CA
3. Commissioning schedules	CA with GC
4. Equipment documentation submittals	Subs
5. Sequence clarifications	Subs and A/E as needed
6. Prefunctional checklists	CA
7. Startup and initial checkout plan	Subs and CA (compilation of existing documents)

<u>Product</u>	<u>Developed By</u>
8. Startup and initial checkout forms filled out	Subs
9. Final TAB report	TAB
10. Issues log (deficiencies)	CA
11. Commissioning progress record	CA
12. Deficiency reports	CA
13. Functional test forms	CA
14. Filled out functional tests	CA
15. O&M manuals	Subs
16. Commissioning record book	CA
17. Overall training plan	CA and GC
18. Specific training agendas	Subs
19. Final commissioning report	CA

END OF SECTION

SECTION 01 91 13
BUILDING ENCLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Commissioning requirements common to all Building Enclosure-Related Sections.
- B. Validation of proper and thorough installation of Building Enclosure components.
- C. Building enclosure component and system performance verification.
- D. Documentation of tests and installations.
- E. Coordination and requirements for field mock-up, trial installation and Performance Testing events.
- F. Preparation and coordination of Building Enclosure Commissioning Report.

1.2 GENERAL DESCRIPTION

- A. Statement of Building Enclosure Design Intent (BEDI): The design intent of this building enclosure is to provide a below grade, façade and roof assembly which limits air infiltration to the specified levels as required by the individual Building Enclosure (BE) technical sections in Divisions 03 through 09, that eliminates uncontrolled water infiltration (including condensation), provides thermal insulation continuity; and includes products and assemblies that are technically sound, durable and serviceable.
- B. Building Enclosure Commissioning (BECx) facilitates a quality oriented process to verify that all building enclosure components are installed and perform collectively according to the BEDI and that the installation is adequately tested and that the specified performance is verified and documented. It serves as a tool to identify deficiencies in the building enclosure during the preconstruction and construction phases in an effort to advance the building enclosure components from mock-up installations, through installation of the separate components on the structure, to a fully integrated, weather-tight assembly prior to occupancy, thereby reducing impact on the building end user.
- C. The Building Enclosure Commissioning Coordinator (BECxC) shall work with the Contractor and Contractor's Quality Assurance and Quality Control Plan and personnel to oversee the BECx processes and performance testing. The BECxA will observe tests as deemed appropriate. All required testing, unless otherwise specified will be performed and paid for by the Owner.

1.3 SCOPE

- A. This Section includes building enclosure commissioning procedures, including below grade systems, exterior facade enclosure, and roofing or other construction that protects climate-controlled interior spaces from unconditioned spaces and the exterior environment, as follows:
 - 1. Building enclosure construction, above grade, is including exterior opaque walls, windows, and doors including sheathing, framing, insulation and vapor barrier (as required).
 - 2. Roofing, including roofing system, roofing insulation, and skylights, hatches, and other roof openings and penetrations.
 - 3. Below grade water proofing systems and sub-drainage.
 - 4. The aforementioned items including continuity between all sections (where applicable).
- B. Materials, Product and Assembly Performance Testing as required by individual sections, and/or as outlined in Part 3 of this specification. All performance values shall be as described within each relevant section of the Project Specification.
- C. Record Documents related to BECx.

1.4 RELATED WORK AND DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. **Commissioning Specifications:** See Division 01 Section 01 91 00 - General Commissioning Requirements for general requirements for MEP commissioning including definitions, means and methods for conducting the commissioning process, commissioning team members, Owner's responsibilities, Contractor's responsibilities, and Commissioning Authority's responsibilities.
- C. **Individual Building Enclosure Specification Sections:** Individual building enclosure technical sections (Divisions 03-09) stipulate requirements for material testing, and warranties for the material, product or assembly specified in the Section. Installation, product testing, and assembly testing are stipulated in each section and/or Part 3 of this section.

1.5 DEFINITIONS AND ABBREVIATIONS

- A. **Action Item (AI):** Any issue that requires a response, completion, corrective or additional work, or any other action related to the construction. Examples include a Contractor's Request for Information (RFI), an Architect's Field Directive, a clarification request, or a documented deficiency in the Work. Action Items must be categorized and assigned to the appropriate party for remedial action.

- B. **Action List (AL):** This is a list that is maintained and updated by the BECxA that includes all Action Items that relate to BECx activities, including a summary description of each AI (including photograph where appropriate), the date that each AI was first documented, the appropriate party responsible for remedial action, the date corrective action was performed, and a brief summary of the remediation.
- C. **A/E:** Architect/Engineer-of-Record.
- D. **Commissioning (Cx):** The process of ensuring that all building systems perform interactively according to the design intent, the systems are efficient and cost effective and meet the Owner's Project Requirements.
- E. **Building Enclosure Commissioning Agent (BECxA):** The Party retained by the Owner will oversee the BECx process, develop and stipulate many of the BECx requirements, manage the BECx process, and validate that building enclosure systems are designed, installed and tested to meet the Owner's requirements and/or contract documents provided by the Architect-of-Record.
- F. **Commissioning Portal:** This is an internet hub for the collaboration on Cx and BECx information. This portal will act as a hub for posting electronic information.
- G. **Commissioning Report:** The *Commissioning Report* is the final deliverable from the Cx process, and provides the information needed to understand and maintain the facility's building enclosure. It should be the repository of all updates and corrections as they occur (even through occupancy). The *Facility Manual* expands the scope of standard O&M documentation to incorporate additional information developed through the commissioning process. This is also often called a 'Systems Manual' throughout ASHRAE Cx references. Traditionally this manual has documented only the MEP systems. For this project, the facility manual will also include the Building Enclosure Commissioning (BECx) Documents.
- H. **Commissioning Team (CxT):** The group of Parties involved in the commissioning process for any given system. The group is typically comprised of representatives from:
1. Owner (PM) and his/her consultants
 2. General Contractor and/or Construction Manager (GC or Contractor/CM)
 3. Designer and design engineers (particularly the architect and engineers – A/E)
 4. Building Enclosure Commissioning Agency (BECxA)
 5. Test Technician (TT) (as either trade quality control or BECxA)
 6. Building Enclosure subcontractor and their sub-subcontractors (BESC)
 7. Specialty subcontractors ((insert other relevant trades where applicable i.e., subcontractor, etc.))
 8. Any other installing subcontractors or suppliers of materials or systems.
- I. **Construction Phase:** Phase of the project during which the facility is constructed. During this phase the Contractor and subcontractors complete the installation and field testing requirements.

- J. **Contract Documents:** The documents governing the responsibilities and relationships between Parties involved in the design and construction of this project including (but not necessarily limited to):
- i. Agreements/Contracts;
 - ii. Construction Document Drawings and Specifications;
 - iii. Addenda;
 - iv. Change Orders;
- K. **Construction Documents:** Refers generally to the Contract Documents that dictate the details of construction (all but item i. and v. above).
- L. **Deficiency:** A condition in the installation or function of a material, assembly, or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the Design Intent).
- M. **Contractor:** As used herein, 'Contractor' is a general reference to the installing Party and can therefore refer to the GC, subcontractors, or vendors as inferred by its usage.
- N. **BECx Software:** A software tool used for collaborative commissioning information management. To be provided by and maintained for this project by the MEP Commissioning Authority.
- O. **Building Enclosure Commissioning (BECx):** The process of facilitating the quality installation of the building enclosure materials, components, and systems in accordance with the contract documents and satisfy the requirements of the BEDI.
- P. **Building Enclosure Commissioning Coordinator (BECxC):** This refers to the Individual that is designated the POC for BECx activities.
- Q. **Factory/Laboratory Testing:** Off-Site Testing of Building Enclosure materials, components and systems at the manufacturer's facility and/or independent Testing Agency. This testing will be witnessed and documented by the members of the BECx team as appropriate and as specified in the BE technical specifications.
- R. **Field Testing Authorized/Accredited Representative:** On-site testing of Building Enclosure materials, components and systems conducted by an authorized Manufacturer's Technical Representative and/or independent Testing Agency.
- S. **Manufacturer's Technical Representative:** An individual in direct employ of the manufacturer of the applicable material, component, or system who is technically qualified in the judgment of BECxA to perform the applicable work for which the reference is made.
- T. **Party:** Entity legally responsible for portion of work.
- U. **Project Management Consultant (Owner):** Project management consultant to the Owner.

- V. **Point of Contact (POC):** General reference to the key individual within each Party.
- W. **Project Phases:** Phases of the project including the Pre-Construction Phase, The Construction Phase, and The Warranty Phase, including Post-Occupancy Evaluation to be completed at the Owner's discretion by the appropriate members of the Commissioning Team for this project.
- X. **RFI:** Request for Interpretation
- Y. **Substantial Completion:** As defined in the Owner-Contractor agreement. This milestone will coincide with the end of the Construction Period and the acceptance of the Property, or portions thereof, by the Owner. This milestone also coincides with the start of the warranty period.
- Z. **Testing Agency:** An independent agency, fully accredited by the appropriate governing body for each of the materials, components or systems to be tested or evaluated for compliance with requirements of the contract documents. The Testing Agency shall submit qualifications as required in Section 01450 and individual BE technical sections for review and acceptance by the A/E and BECxA.
- AA. **Warranty Phase:** Beginning on the date of Substantial Completion and continuing through the Warranty Period of each Building Enclosure material, component, and system.

1.6 REFERENCE STANDARDS

- A. ASHRAE NIBS Guideline 3-2006, "Exterior Enclosure Technical Requirements for the Commissioning Process"
- B. Reference standards as identified in the individual Building Enclosure technical sections of this specification.

1.7 DOCUMENTATION

- A. The Contractor shall provide a letter, signed by the Contractor and all relevant subcontractors stating that each acknowledges in writing that the Owner regards the new building enclosure to be an important and performance-sensitive single element of the project. In support of this requirement, the Contractor must also acknowledge that they are solely responsible for the quality and coordination of all building enclosure materials, components and systems such that they result in a fully integrated, weather-tight building enclosure that is in compliance with the Contract Documents and satisfies the BEDI.
- B. The Owner shall provide to the BECxA (and maintain) two sets of current contract documents for review and comment at the earliest possible time prior to the onset of construction. BECxA shall perform a constructability review and provide comments related to the durability, performance and BE conformance with the Owner Project Requirements for consideration by the Owner, A/E and Contractor.

- C. The Contractor shall provide to the BECxA the following per the procedures specified herein and in other BE Technical Sections of the specification (Divisions 03-09):
1. Shop Drawings and Product Data: Provide shop drawings and submittal data for materials, products, systems and equipment that will be part of the BECx process. Refer to Section 01 91 00 for additional requirements.
 - a. The Contractor shall forward to the BECxA one copy of Shop Drawings and Product Data concurrent with distribution to the A/E. BECxA shall review and provide comments to the Owner and A/E, who will then review and incorporate the BECxA comments at their discretion and return to the Contractor. The Contractor shall then copy BECxA with the reviewed submittal with A/E submittal review stamp.
 - b. Any action taken by the A/E or Contractor based in whole or in part on the comments and recommendations provided by the BECx as part of its submittal review shall be the sole responsibility of the A/E or Contractor.
 2. Factory/Laboratory Test Reports: The Contractor shall provide any factory or laboratory testing documentation or certified test reports required by the specifications. These shall be provided prior to acceptance and installation of the specific item.
 3. Schedule Updates: The Contractor shall issue periodic updates to the construction schedule every two week or less as appropriate. Contractor shall use schedule to notify BECx team of scheduled tests and milestone installation events. Contractor shall coordinate with BECxA for meetings as appropriate prior to and during construction.
 4. Action Item Response: Respond to Action Items to which BECx team members assign the Contractor responsibility within 10 business days of issue.
 5. Testing Agency Reports. Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to acceptance by A/E and installation.
- D. Record Drawings: The Contractor shall maintain at the site an updated set of record or 'As-Built' documents reflecting actual installed conditions and all approved changes and modifications to the contract documents. The Contractor shall provide access to the BECxA to review the As-Built and Record Drawings. The Record Drawings shall be maintained concurrently with construction.

1.8 COORDINATION MANAGEMENT PROTOCOLS

- A. Unless otherwise defined and agreed to by the parties to the contract documents for this project, coordination responsibilities and management protocols relative to BECx are defined below, subject to further refinement during the Construction Phase BECx pre-construction meeting.
1. Submittals and Shop Drawings: The BECxA shall review submittals and shop drawings in accordance with paragraph 1.7.C.1 above and Section 01 91 00.
 2. Deficiencies Identified by the BECxA: When the BECxA identifies a deficiency, the Contractor shall make a good faith assessment of responsible parties. Those parties shall be notified of the perceived deficiency. This communication is for information only and is not a direction to resolve the deficiency. Contractor may accept responsibility and resolve the deficiency voluntarily. If Contractor contests either the deficiency or responsibility for that deficiency, Contractor shall respond to that affect in writing to the BECxA. If a consensus is not reached as a result of this process, then the Contractor shall issue a work directive or RFI response via the normal contractual channels to resolve the issue.
 3. Requests for Meetings (beyond regularly scheduled meetings): In general request by the Contractor for additional meetings with the BECxA shall be routed through the Owner who will then confirm the necessity for the meeting. Note that every attempt should be made to deal with BECx issues at regularly scheduled BECx Meetings.
 4. Scheduling Coordination – Contractor shall review the BE technical specifications, identify required BECx items (including field and laboratory test requirements, specified test standards, mock-ups, product submissions, milestone installations and similar) and provide a schedule to the BECxA with anticipated dates for each. It is the responsibility of the Contractor to provide adequate time from submission of each BECx requirement to response from the BECx, and resolution of any identified deficiencies without unnecessary deleterious impact on the project schedule.
 5. Notification of Completion Milestones – Contractor shall notify Owner and BECxA at least two weeks prior to an anticipated BECx activity or BECx milestone (such as installation of a new façade component). Contractor and BECxA shall then coordinate the scheduling of the activity between all required parties as applicable. Notification shall be via e-mail.
 6. Action List: BECxA maintains a categorized Action List which tracks the BECx related action items. All content of the Action List will be available to all parties who have credentials on the portal. Any party with credentials may post an Action Item. Any party that is copied on an email resulting from an Action Item posting may respond to it and contribute to the dialogue.

1.9 CONTRACTOR'S RESPONSIBILITIES

- A. As defined in this Section and in the individual BE technical sections, including but not limited to the following:
 - 1. Attend the routine BECx meetings (typically every two weeks).
 - 2. Coordinate and Chair preconstruction and construction-phase coordination meetings.
 - 3. Provide summary and schedule of laboratory and field quality control tests and inspections required by the Contract Documents to BECxA.
 - 4. Participate in Pre-construction Mock-Up and Field testing coordination meetings.
 - 5. Coordinate with the BECxA pre-construction and construction testing and submit laboratory and field quality control testing, field checklists and inspection reports on building enclosure construction to the BECxA. Perform out of sequence work as required to facilitate field tests.
 - 6. Submit maintenance data for products, assemblies, and components to the BECxA.
 - 7. Provide test data, inspection reports, and certificates to BECxA.
 - 8. Review and respond to AI in a timely manner (typically within 10 business days).
 - 9. Contractor is responsible for the cost of all re-tests and compensation of time for Architect and BECxA related to all additional work necessitated by re-testing of specimens following an initial test failure.
 - 10. Provide input for final commissioning documentation.

1.10 A/E RESPONSIBILITIES

- A. As defined in this Section and in the individual BE technical sections, including but not limited to the following:
 - 1. Attend the routine BECx meetings.
 - 2. Attend preconstruction and construction-phase coordination meetings.
 - 3. Participate in Pre-construction Mock-Up and Field testing coordination meetings.
 - 4. Provide resolution to items for which the BECxA and Contractor may be in disagreement.
 - 5. Provide input for final commissioning documentation.

1.11 BECxA RESPONSIBILITIES

- A. Participate in Project-Specific mock-ups and outline the commissioning process Functional Performance Test procedures.
- B. Witness building enclosure component testing, milestone installations, and perform periodic site visits to document that work is being performed in compliance with the project specifications and Part 3.
- C. Conduct routine BECx meetings to review progress on AI list and resolve issues affecting the building enclosure.

- D. Compile test data, inspection reports, and certificates and provide them to the CxA for inclusion in the Commissioning Report.

1.12 PERFORMANCE TESTING (BUILDING ENCLOSURE)

- A. Quality Assurance and Control: Specific BECx quality-assurance and quality-control requirements for individual Building Enclosure and materials, methods, and assemblies are specified in the BE Technical Sections relating to those activities. Specified commissioning tests, inspections, and related actions are specified in Part 3 of this section, do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
- B. The objective of Functional Performance Testing is to demonstrate that each Building Enclosure system, and system-to-system interfaces meet or exceed the performance requirements of the Contract Documents and the BEDI.
- C. Costs associated with re-testing caused by failure of the building enclosure tests, during mock-up or construction phase work shall be the responsibility of the Contractor.

1.13 DEFICIENCIES IDENTIFIED DURING BE FUNCTIONAL PERFORMANCE TESTING

- A. **Non-Conformance.** Non-conformance deficiencies identified during Periodic Site Visits or Functional Performance Testing shall be resolved as follows:
 - 1. The BECx will record the results of the review / functional performance test. All deficiencies or non-conformance issues shall be noted as Action Items and reported to the Contractor.
 - 2. Corrections of identified minor deficiencies may be made during the review / tests at the discretion of the BECx. In such cases the deficiency and associated resolution will be documented in the Action Item list.
 - 3. Every effort will be made by the BECx to expedite the review / testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
 - 4. As reviews / tests progress and a deficiency is identified, the BECx will discuss the issue with the Contractor for follow-up and resolution.
 - a. When there is no dispute with respect to the deficiency and the Contractor accepts responsibility to correct it:
 - 1) The BECx shall document the deficiency and the Contractor's response. A copy/email of the deficiency shall be generated and provided to the Contractor. The Contractor corrects the deficiency, completes the Action Item response certifying that the issue is resolved and /or the product, material or assembly is ready to be retested and notifies the Project Team.
 - 2) The Contractor reschedules the test and the test is repeated. This process is repeated until the test result(s) meets or exceeds the requirements of the

contract documents and, at the discretion of the Owner, the remedial action taken will be implemented on a project-wide basis where applicable. The Contractor is responsible for all retest costs incurred by the BECxA, test agency, Owner and A/E.

- b. If there is a dispute about a deficiency:
 - 1) The deficiency shall be documented as an Action Item with the Contractor's response and the Contractor will be notified. The Contractor will track this issue under the construction contract dispute resolution provisions.
 - 2) Final interpretive authority is with the Owner. Final acceptance authority is with the Owner or A/E.
 - 3) The BECxA documents the resolution to the Action Item.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, and responds to the Action Item indicating completion. The Contractor reschedules the review / test and the review / test is repeated until satisfactory performance is achieved. The Action Item is then considered as closed.

B. **Failure:** As defined in each BE Technical Sections (Divisions 03-09) and/or Part 3. In event of test failure the Contractor shall provide the Owner with the following:

1. Installer/Manufacturer's response in writing as to the cause of the failure and proposed resolution.
2. Installer/Manufacturer shall implement their proposed resolution on a representative sample of the product.
3. The Owner will determine whether a replacement of all identical units is required or if a repair is acceptable.
4. Upon acceptance, the responsible Party shall replace or repair all identical items at their expense and shall extend the warranty accordingly.
5. Systemic or frequent failures may result in additional testing beyond originally identified to verify performance. Additional costs to test systems due to deficiencies are to be borne by the responsible Contractor.

1.14 COMMISSIONING REPORT CONTENT

A. Report content and format shall be as specified in Section 01 91 00.

B. Commissioning Report

1. **Maintenance Schedule:** Contractor will provide a summary table that indexes the building enclosure component requiring maintenance and indicates the frequency each component will require repair or replacement (i.e. replacement of sealants, gaskets, IGUs, repair of paints or coatings). Contractor will provide subcontractors with an *Excel* spreadsheet that will be completed by each applicable subcontractor and returned to the Contractor for incorporation in the Commissioning Report by the BECxA.

2. **Maintenance Information** Contractor shall provide Maintenance Information for each entry containing the following:
 - a. Product Data Sheet: Provide a summary of performance data.
 - b. Extended Warranty Information: Include all warranties for products, equipment, components, and sub-components whose duration exceeds one year. Include warranties on components with the system they are a part of. Reference all specific operation and maintenance procedures that must be performed to keep the warranty valid.
 - c. Sources of Material: Include reference to contact information where specific materials can be obtained.
 - d. Installation and Maintenance Instructions: For each material, component or system.

C. Construction Documentation

1. **Record Drawings**: Contractor shall provide an index of all record drawings with drawing number, title, and electronic file name(s) including electronically referenced drawings.
2. **Record Specifications**: Contractor shall provide a detailed index of the record specification. Include sections and major items in the specification all indexed to the appropriate page number.
3. **Approved Product Data and Shop Drawings**:
 - a. Contractor shall provide an index of all product data and shop drawings. This shall list all BE materials, components or systems with the associated submittal number
 - b. Contractor shall organize and compile only approved product data and shop drawings. Providing these in a filing format is acceptable provided all files are identified and organized for easy access.
 - c. Inclusion of any of this information in previous sections of the Commissioning Report does not allow exclusion in this section.
4. **Commissioning Record**: BECxA shall provide complete commissioning records including all Performance Test documentation, in both written and electronic format at the discretion of the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 BE PERFORMANCE TESTING

- A. **Site Testing**: In coordination with the Contractor, the BECxA will evaluate in-service performance of building enclosure assemblies and construction, and submit reports.

1. Provide site testing as scheduled at the end of this Section or each BE section (03-09).
 2. Carry out testing in accordance with Section 01 91 00.
- B. Adhesion Tests: Arrange for field tests to take place with joint-sealant and adhered membrane manufacturer's technical representative present. Field test sealant joints and self-adhering membranes for adhesion to substrates as follows:
1. Test each type of sealant/membrane in each installation at every substrate indicated.
 2. Perform sealant tests in compliance with ASTM C1521 Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints, Method A or ASTM D4541 Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
 3. Test field installed sealant / membrane systems at mock-ups, 10 percent, 50 percent, and 70 percent intervals of completed work during the construction period.
 4. For joints between dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. For sealants that fail adhesively, retest until satisfactory adhesion is obtained. Do not use sealants that fail to adhere to joint substrates during testing.
- C. Fenestration Field Water Tests:
1. Test installed fenestration systems according to AAMA 501.2 "Field Check of Metal Storefronts, Curtain Walls and Sloped Glazing Systems For Water Leakage," ASTM E-1105: Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Differential, and AAMA 501.1 "Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure."
 2. Complete testing prior to installation of interior insulation and gypsum board.
 3. Contractor to provide powered scaffold, hose, water supply, communication system and manpower to perform tests.
 4. Test field installed glazing systems at mock-ups, 10 percent, 50 percent, and 70 percent intervals of completed work during the construction period.
 5. Contractor will work with the Test Engineer and CxA to determine necessity for additional test methods and for field chamber tests based upon evaluation of initial test results. The BECxA will interpret marginal results and adjust the test procedures as appropriate.
 6. Contractor to perform out-of-sequence work as required facilitating system tests.
- D. Fenestration Field Air Leakage Tests:
1. Test installed fenestration systems and interfaces with adjacent substrates according to ASTM E-783: Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 2. Complete testing prior to installation of interior insulation, gypsum wall board and interior finishes or systems that may impede the completion of the tests.
 3. Test specimen to include the perimeter material substrate and the perimeter seals.
 4. Contractor to provide powered scaffold, hose, water supply, communication and manpower to perform tests.

5. Test installed fenestration systems at mock-ups, 10 percent, 50 percent, and 70 percent intervals of completed work during the construction period.
 6. Contractor will work with the Test Engineer and BECxA to determine necessity for additional test methods and for field chamber tests based upon evaluation of initial test results. The CxA will interpret marginal results and re-write the test procedures as appropriate.
 7. Contractor to perform out-of-sequence work as required facilitating system tests. Contractor to install all air seals / dams concealed within the mullions to facilitate air tests at curtain wall assemblies.
- E. Air Barrier Field Air Leakage Tests:
1. Test installed air barrier systems and interfaces with adjacent substrates according to ASTM E1186 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems and ASTM E-783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 2. Complete testing prior to installation of interior insulation, gypsum wall board and interior finishes.
 3. Test specimen to include the perimeter material substrate and the perimeter seals.
 4. Provide powered scaffold, water, electric supply, communication and manpower to perform tests.
 5. Test installed air barrier systems at mock-ups, 10 percent, 50 percent, and 70 percent intervals of completed work during the construction period.
 6. Contractor will work with the Test Engineer and CxA to determine necessity for revised test methods and for field chamber tests based upon evaluation of initial test results. The CxA will interpret marginal results and adjust the test procedures as appropriate.
 7. Contractor to perform out-of-sequence work as required facilitating system tests.
- F. Fenestration Mock-up Thermal Tests:
1. Test installed glazing assemblies according to AAMA 501.5 Test Method for Thermal Cycling of Exterior Walls, modified to include thermocouples to determine surface temperatures below the design dew point temperature.
 2. Install thermocouples prior to installation of any interior insulation and interior drywall finishes. Complete testing after installation of interior insulation, gypsum wall board and interior finishes to simulate interior conditions.
 3. Test fenestration systems at mock-up.
- G. Roof Field Water and Air Leakage Tests:
1. Test installed roofing systems and interfaces with adjacent substrates using high- or low-voltage electronic leak detection and ASTM C1153 Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging and Capacitance.
 2. Test installed roofing systems and interfaces with adjacent substrates according to ASTM E1186 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 3. Complete testing prior to installation of interior insulation, gypsum wall board and interior ceiling finishes.
 4. Test 100% of roof areas.

5. Contractor to provide powered scaffold, water, electric supply, communication and manpower to perform tests.
6. Contractor will work with the Test Engineer and CxA to determine necessity for revised or supplemental test methods. The CxA will interpret marginal results and adjust the test procedures as appropriate.
7. Contractor to perform out-of-sequence work as required facilitating system tests.

H. Waterproofing Field Water and Air Leakage Tests:

1. Test installed waterproofing systems and interfaces with adjacent substrates according to ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations, or high- or low-voltage electronic leak detection.
2. Test installed waterproofing systems and interfaces with adjacent substrates according to ASTM E1186 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
3. Complete testing prior to installation of interior insulation, gypsum wall board and interior ceiling finishes.
4. Test 100% of waterproof areas.
5. Contractor to provide powered scaffold, water, electric supply, communication and manpower to perform tests.
6. Contractor will work with the Test Engineer and CxA to determine necessity for revised or supplemental test methods. The CxA will interpret marginal results and adjust the test procedures as appropriate.
7. Contractor to perform out-of-sequence work as required facilitating system tests.

3.2 FIELD TEST SCHEDULE

A. Source quality control testing schedule:

Field quality control testing schedule: DRAFT

Location / Test Type	Testing Standard	Description	Criteria	Schedule & Number of Tests
Mockup testing:		2 bays wide x 2 stories tall		
Air Barrier	ASTM E1186	Qualitative air leakage testing	NA	one representative area
Air Barrier	ASTM D4541	Adhesion testing	NA	2 locations

Air Barrier transitions to adjacent systems, field of AB, penetrations	ASTM E783	Field air leakage pretest for air barrier assembly (prior to cladding installation)	0.04 cfm/sq.ft at 1.57 lbf/sq.ft.	1
Curtain Wall	ASTM E783	Field air leakage pretest (prior to cladding installation)	<0.06 cfm/sq.ft at 6.24 lbf/sq.ft.	1
Curtain Wall, including air barrier interface	ASTM E1105	Field water leakage pretest (prior to cladding installation)	no water at 0.67x (15lbf/sq.ft. or 20% of wind load)	1
Air Barrier transitions to adjacent systems, field of AB, penetrations	ASTM E783	Field air leakage test for air barrier assembly	0.04 cfm/sq.ft at 1.57 lbf/sq.ft.	1
Curtain Wall	ASTM E783	Field air leakage test	<0.06 cfm/sq.ft at 6.24 lbf/sq.ft.	1
Curtain Wall, including air barrier interface	ASTM E1105	Field water leakage test	no water at 0.67x (15lbf/sq.ft. or 20% of wind load)	1
Curtain Wall, including air barrier interface	AAMA 501.1	Dynamic water leakage test	no water at 0.67x (15lbf/sq.ft. or 20% of wind load)	1
Curtain Wall, including air barrier interface	AAMA 501.5 w/ thermocouples, followed by ASTM E783 and E1105	Thermal testing	all surface temperatures above dewpoint conditions	1
Air leakage testing:				

Aluminum Storefront	ASTM E783	Field air leakage testing	<0.09 cfm/sq.ft at 6.24 lbf/sq.ft.	10% completion: 1 tests
Curtain Wall	ASTM E783	Field air leakage testing	<0.09 cfm/sq.ft at 6.24 lbf/sq.ft.	10% completion: 1 tests
Air Barrier transitions to adjacent systems, field of AB, penetrations	ASTM E783	Field air leakage tests for air barrier assembly	0.04 cfm/sq.ft at 1.57 lbf/sq.ft.	10% completion: 1 tests
Air Barrier transitions to adjacent systems, field of AB, penetrations	ASTM E1186	Field air leakage tests for air barrier assembly		9 locations throughout construction (6 smoke test and 3 bubble gun areas @ 20 tests each)
Roofing membrane transitions to adjacent systems, field of AB, penetrations	ASTM E1186	Field air leakage tests for air barrier assembly		2 locations (2 bubble gun areas @ 20 tests each)
Water leakage testing:				
Skylight	AAMA 501.2	Field water leakage test-nozzle	no water	10% and 50%
Curtain Wall & AB interface	ASTM E1105	Field water leakage test	no water at 0.67x (15lbf/sq.ft. or 20% of wind load)	1 location each @ 10%, 50%, and 70% completion (3 total tests).
Storefront & AB interface	ASTM E1105	Field water leakage test	no water at 0.67x (15lbf/sq.ft. or 20% of wind load)	1 location @ 10% completion
Curtain Wall & AB interface	AAMA 501.1	Field water leakage test-dynamic	no water at 0.67x (15lbf/sq.ft. or 20% of wind load)	3 locations @ 10% completion

Storefront & AB interface	AAMA 501.1	Field water leakage test-dynamic	no water at 0.67x (15lbf/sq.ft. or 20% of wind load)	3 locations @ 10% completion
Various detailing of water barrier (sealants, AB, roofing, etc)	AAMA 501.2	Field water leakage test-nozzle	no water	TBD
Rubberized Asphalt Membrane		electronic leak detection	no leaks	1 @ 100% completion
TPO		electronic leak detection / capacitance testing (TBD)	no leaks	1 @ 100% completion
Sill pan flashing- Sill Dam Test	AAMA 502, Optional Sill Dam Test	Sill dam water testing	no water	TBD
Adhesion Testing:				
Barrier glazing / joint sealant adhesion	ASTM C1521, Method A	Sealant adhesion	Per manufacturer adhesion test data	10 locations throughout construction
AB, roofing, & WP adhesion	ASTM D4541	Pull-off strength using a portable adhesion tester	Per manufacturer adhesion test data	10 locations (4 AB, 4 roofing, 2 WP) throughout construction
AB transition membrane	ASTM C1521, Method A	Adhesion	Per manufacturer adhesion test data	6 locations throughout construction

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SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Demolition, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Conduct work in accordance with OSHA and EPA requirements.
- B. Use only firms or individual trades qualified to perform work required under this section.

1.3 DESCRIPTION

- A. Work includes:
 - 1. Demolition of portions of structures indicated.
 - 2. Removal of demolition debris.
 - 3. Protection of all construction to remain, including:
 - a. Utilities to remain.
 - b. Structures to remain.
 - c. Other items not indicated to be removed.
- B. Condition of existing structures to be demolished:
 - 1. Laboratory assumes no responsibility for actual condition of structures to be demolished.
 - 2. Conditions existing at time of inspection for bidding purposes will be maintained by Laboratory insofar as practicable.
- C. Where access to existing life-safety features (such as a Fire Department connection) is impacted by construction activities, the Contractor shall provide appropriate temporary measures to ensure access to such features.

1.4 JOB CONDITIONS

- A. Perform preliminary investigations as required to ascertain extent of work.
 - 1. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.
- B. Before start of work, obtain and pay for permits required by authorities having jurisdiction and notify interested utilities companies.
- C. Obtain approval of authorities having jurisdiction for work which affects existing exitways, exit stairs, means of egress, or access to, or exit from, areas.
 - 1. Review with and obtain approval of authorities for temporary construction which affects such areas.
 - 2. Obtain approval of fire authorities.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 POLLUTION CONTROLS

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations.
- B. Return adjacent areas to condition existing prior to start of work.

3.2 ITEMS TO BE SALVAGED FOR LABORATORY

- A. Remove salvage items at appropriate stage of demolition, but early enough to prevent damage to them by demolition operations:
 - 1. Items to potentially be salvaged are indicated on the demolition drawings.
 - 2. Verify and coordinate with Laboratory items Laboratory wishes to save.
 - 3. If Laboratory opts to not receive salvaged item, Contractor shall remove item from site and dispose as demolition material.
- B. Remove salvage items as a unit:
 - 1. Clean, list, and tag for storage.
 - 2. Protect from damage.
 - 3. Salvage each item with auxiliary or associated equipment required for operation.
 - 4. Store in building designated by Laboratory.

3.3 ITEMS SALVAGED FOR CONTRACTOR

- A. Items of salvage value to Contractor may be removed from structure as work progresses.
- B. Transport salvaged items from site as they are removed.
- C. Storage or sale of removed items not permitted on site.

3.4 ITEMS TO BE REMOVED FOR RE-INSTALLATION IN PROJECT

- A. Remove items designated for re-use:
 - 1. Tag, protect from damage, store if required, and deliver to locations designated.
 - 2. Brace motors attached to flexible mountings until reinstallation.

3.5 GENERAL DEMOLITION PROCEDURES

- A. Demolition of entire portions of structures:
 - 1. Demolish completely and remove from site.
 - 2. Use such methods as required to complete work within limitations of governing regulations.
 - 3. Coordinate with Laboratory and utility suppliers for shut-off of utilities serving each building and disconnect and seal utilities before starting demolition.
- B. Start and complete work as established by approved schedule; operational procedures and sequence of work are optional provided schedule is maintained.
- C. Protect property to remain:
 - 1. Promptly repair damage caused by demolition, as directed by Architect, at no cost to Laboratory.
 - 2. Conduct operations to prevent damage by falling debris or other cause to adjacent buildings, structures, and other facilities as well as persons.
 - 3. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures.
- D. Conduct operations to ensure minimum interference with roads, walks, entrances, exits, and other adjacent occupied facilities.

1. Do not close or obstruct private drives, walks or other occupied or used facilities unless approved in writing.
 2. Do not close or obstruct public thoroughfares or walks unless approved by authorities having jurisdiction.
 3. Do not obstruct exits from existing facilities without approval of authorities having jurisdiction.
 4. Provide alternate routes around closed or obstructed traffic ways.
- E. Provide covered passageways where necessary to ensure safe passage of persons in or near areas of work.
- F. Provide barricades and safety lights as required.
- G. Maintain existing utilities that are indicated to remain.
1. Keep in service, and protect against damage during demolition.
 2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized by Laboratory.
 3. Provide temporary services during interruptions to existing utilities, as acceptable to Laboratory.
- H. Structural demolition:
1. Demolish concrete and masonry in small sections.
 2. Perform removal to avoid excessive loads on supporting walls, floors or framing.

3.6 PROTECTION OF OCCUPIED FACILITIES TO REMAIN

- A. Protect occupants from injury and discomfort.
- B. Provide temporary dustproof partitions between demolition areas and occupied areas.
1. In public areas use clean, painted, minimum 1/2 IN thick, plywood.
 2. Where authorities having jurisdiction require, use fire rated construction.
- C. Provide temporary weather protection and insulation as necessary to prevent damage to existing facilities and discomfort to persons in occupied areas.
1. Insulation value: R 19.

3.7 CLEAN-UP AND DISPOSAL OF DEMOLITION MATERIALS

- A. Remove debris, rubbish, and materials resulting from demolition operations.
1. Remove from site; legally dispose of off site.
 2. Do not burn materials on site.
- B. Dispose of items and materials not designated by Laboratory or these documents for Laboratory's salvage or reuse.
1. Promptly remove from site.
 2. Do not store or sell Contractor salvaged items or materials on site.
- C. Clean up other debris resulting from this work.

END OF SECTION

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SECTION 03 08 13
CONCRETE TESTING AND EVALUATION - LABORATORY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Testing and Evaluation - Laboratory, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Standards:
 - 1. ASTM-C31: Standard Practice for Making and Curing Concrete Test Specimens in Field.
 - 2. ASTM-C42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 3. ACI 318: Building Code Requirements for Structural Concrete and Commentary.
 - 4. ASTM-E329: Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- B. Contractor's testing agency:
 - 1. Qualifications: Acceptable to Architect/Engineer, with evidence of recent inspection by Cement and Concrete Reference Laboratory of National Institute of Standards and Technology and of having corrected deficiencies noted, and meet requirements of ASTM E 329.
 - 2. Authority: Agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of Contract Documents, nor to approve or accept portion of Work.

1.3 SUBMITTALS

- A. Project information:
 - 1. Contractor's testing agency qualifications.
 - 2. Production sample test reports (when required): Include same data as for mix designs.
 - 3. Reports of Contractor-optional tests.
 - 4. Test reports on in-place testing, if such testing is performed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 DESCRIPTION - GENERAL

- A. Test concrete materials and inspect operations as work progresses. Failure to detect defective work or material shall not prevent later rejection when such defect is discovered nor shall it obligate Architect/Engineer for final acceptance.
- B. Payment for testing:
 - 1. Pay for testing services required in paragraph "Responsibilities and Duties of Contractor."
 - 2. Routine testing of concrete furnished to job site for compliance with Contract Documents will be performed by Laboratory's testing agency at Laboratory's expense.
 - a. Routine testing consists of tests for compressive strength, slump, air, temperature and unit weight.

- b. Tests shall be performed every 75 YD³ or fraction thereof, for each mixture design placed in one day.
- c. Composite samples shall be obtained in accordance with ASTM-C172. Obtain each sample from a different batch of concrete on a random basis. Test batch shall be selected at random before commencement of concrete placement.
- d. Agency shall mold and cure sufficient specimens from each sample in accordance with ASTM-C31 and report deviations from requirements, if any.
- e. Specimens shall be tested in accordance with ASTM-C39. Mold and cure additional cylinder for early testing of post-tensioned concrete.

3.2 RESPONSIBILITIES AND DUTIES OF CONTRACTOR

- A. Provide necessary testing services for qualification of proposed materials and establishment of mix designs. Services performed by Contractor's testing agency.
- B. Submit concrete materials and concrete mix designs proposed for use. Include results of testing performed to qualify materials and to establish mix designs. Place no concrete until Contractor has received approval in writing. See submittals paragraph.
- C. Use of testing service shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.
- D. To facilitate testing and inspection:
 - 1. Furnish labor to assist Laboratory's testing agency in obtaining and handling samples at site or other sources of materials.
 - 2. Advise Laboratory's testing agency sufficiently in advance of operations to allow for completion of routine testing and for assignment of personnel.
 - 3. Provide and maintain adequate facilities for safe storage and proper curing of concrete compressive strength test specimens on site for first 8 HR or until they gain sufficient strength, as required by ASTM-C31.
- E. Pay for following additional testing services to be performed by Laboratory's testing agency, on occasions indicated:
 - 1. Additional testing and inspection, whenever changes in materials or proportions are requested by Contractor.
 - 2. Additional testing of materials or concrete, whenever they fail by test or inspection, to meet specification requirements.
 - 3. Other testing services needed or required by Contractor, such as:
 - a. Additional field cured test specimens as needed for control of work by Contractor such as, when concrete may be stripped, reshored, unshored, post-tensioned, etc.

3.3 EVALUATION AND ACCEPTANCE OF COMPRESSIVE STRENGTH TEST RESULTS

- A. Evaluate test results for standard molded and cured test cylinders separately for each concrete mix design. For evaluation of potential strength and uniformity, each mix design shall be represented by at least five tests.
- B. Strength level of concrete will be considered acceptable so long as averages of sets of three consecutive strength test results equal or exceed specified strength (f'c) and no individual strength test result falls below specified strength (f'c) by more than 500 PSI.

3.4 TESTING CONCRETE IN PLACE

- A. When compressive strength tests indicate potential strength deficiency of in-place concrete, testing of concrete in place may be required as an aid in evaluating actual strength. If required, Contractor pay for concrete tests and engineering time and analysis required to evaluate actual in-place concrete strength made necessary by deficient strength cylinder tests.

- B. Testing by rebound hammer, ultrasonic, or other non-destructive device: Such tests shall be used to determine relative strengths at various locations in structure as an aid for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, will not be used as a basis for acceptance or rejection.
- C. Core tests: Obtain and test largest practical diameter cores, 2 IN minimum, in accordance with ASTM-C42. If concrete in structure will be dry under service conditions, air dry cores temperature 60 to 80 degF, relative humidity less than 60 percent for 7 days before test. Test dry. If concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning.
 - 1. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient in strength. Location will be determined by Architect/Engineer. If, before testing, one or more of cores indicates evidence of having been damaged subsequent to or during removal from structure, replace it.
 - 2. Concrete in area represented by a core test will be considered acceptable if average strength of cores is equal to at least 85 percent of, and if no single core is less than 75 percent of, specified strength ($f'c$).
 - 3. Fill core holes with low slump patching compound per Section 03 35 00.

3.5 ACCEPTANCE OR REJECTION OF CAST-IN-PLACE CONCRETE

- A. General:
 - 1. Completed concrete work which conforms to applicable requirements of Contract Documents will be accepted without qualification.
 - 2. Concrete work which fails to conform to one or more requirements of Contract Documents is rejected and will not be accepted until remedied in accordance with 3.4 B, 3.4 C, and 3.4 D.
 - 3. Contractor pays costs incurred in providing remedial work necessary to change rejected work to accepted work. Remedial work includes, but is not necessarily limited to, applicable repairs, replacement, reinforcement, engineering, and testing as denoted in following paragraphs.
- B. Dimensional tolerances:
 - 1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances are potentially deficient in strength and subject to provisions of Paragraph 3.4 D.
 - 2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances will be rejected if strength or finish of structure is not acceptable, or function is adversely affected. Otherwise members will be accepted. If surfaces are rejected, and removal of excess material is permitted, repair of surfaces in an approved manner will constitute acceptance. If surfaces are rejected, and removal of excess material is not permitted, replacement of member(s) in an approved manner will constitute acceptance.
 - 3. Concrete member(s) cast in wrong location will be rejected if strength or finish is not acceptable, function is adversely affected or they interfere with other construction. Otherwise, member(s) will be accepted. If they are rejected, replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.
 - 4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view will be rejected. Repair of surfaces or replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.
- C. Finish:
 - 1. Slabs:
 - a. Finished slabs exceeding tolerance limits of Section 03 35 00 will be rejected if finish is not acceptable and function is adversely affected. If rejected, repair of finished surfaces or replacement of slab in an approved manner and in conformance with Contract Documents will constitute acceptance.
 - b. Repair may involve removing high spots with a terrazzo grinder, filling low spots with a patching compound, or other remedial measures as permitted.
 - 2. Formed surfaces:

- a. Concrete exposed to view with defects which adversely affect appearance of specified finish will be rejected. Repair of surface defects in conformance with Section 03 35 00 will constitute acceptance.
 - b. Concrete not exposed to view is not subject to rejection for defective finish.
- D. Strength of structure:
- 1. Strength of structure in place will be considered potentially deficient and will be rejected if it fails to comply with requirements which control strength of structure, including but not necessarily limited to following:
 - a. Deficient concrete strength based on compressive strength tests.
 - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with requirements on reinforcement.
 - c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
 - d. Curing less than that specified, likely to result in deficient concrete strength.
 - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
 - f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
 - g. Substandard workmanship likely to result in deficient strength.
 - 2. When strength of structure is considered potentially deficient and is rejected, it will not be accepted until one of following remedies is completed. All proposed fixes to repair deficient concrete should be submitted by Contractor to Engineer for review and approval prior to any action by Contractor.
 - a. Confirmation of safety of structure by structural analysis.
 - b. Core tests per 3.3 C. Performed only when concrete strength is potentially deficient, and when safety of structure is not confirmed by structural analysis. Do not use if impractical to obtain or not feasible.
 - c. Confirmation of safety of structure by load tests performed and evaluated in accordance with ACI 318. Do not use if impractical to perform or not feasible.
 - d. Replacement of structure deficient in strength.
 - e. Subject to functional feasibility and Laboratory's approval, structure deficient in strength may be reinforced with supplement supports as directed by Architect.

END OF SECTION

SECTION 03 11 00
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Formwork, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design, engineering, and construction of formwork are responsibility of Contractor.
 - 1. Design, engineer, and construct formwork for applicable gravity and lateral loads and pressures as well as other design considerations or applicable requirements of legal local building code.
 - 2. Develop shoring and re-shoring pattern and sequence so as not to exceed safe structural capacity of supporting structural systems. Confer with Architect, if there is any question, regarding the capacity of the structural system.
- B. Design, prepare formwork drawings and construct formwork in accordance with ACI 347, Guide to Formwork for Concrete.
- C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.

1.3 DESCRIPTION

- A. Definition(s):
 - 1. Formwork: Total system of support for freshly placed concrete including mold or sheathing which contacts concrete as well as supporting members, hardware, and necessary bracing.
 - 2. Exposed construction: Exposed to view.
 - 3. Exposed to view: Concrete surfaces seen by the public from eye level from any walking surface in a public location after completion of building.
 - 4. Public location: Building areas accessible to public and employees not responsible for maintenance. Storerooms, unfinished space and large mechanical rooms are considered public locations. Equipment closets, elevator and mechanical penthouses are not public space.
- B. Use forms, wherever necessary, to confine concrete and shape it to required dimensions. Use forms of sufficient strength to withstand pressure resulting from placement and vibration of concrete, with sufficient rigidity to maintain specified tolerances.
- C. See concrete finish requirements in Section 03 35 00.
- D. Use earth side forms for spread footings, pile caps and unfinished grade beams where earth can be shaped to a straight and true surface. Do not use earth cuts as forms for other vertical surfaces unless permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Form facing materials: As indicated under description of finishes required.

- B. Form accessories, partially or wholly embedded in concrete, such as ties and hangers: Shall be of a commercially manufactured type. Do not use non-fabricated wire. Use form ties constructed so ends or end fasteners can be removed without causing appreciable spalling of concrete faces. After ends or end fasteners of form ties have been removed, embedded portion of ties shall terminate not less than 2 diameters or twice minimum dimension of tie from formed faces of concrete to be permanently exposed to view, but in no case less than 3/4 IN. When formed face of concrete is not to be permanently exposed to view, form ties may be cut off flush with formed surfaces. Use ties with 3/4 IN diameter cones on both ends for water retaining structures.
- C. Textured finish (Form Liner):
 - 1. Base:
 - a. Fitzgerald Formliners
 - b. Dayton superior
 - c. Green streak
 - 2. Units of face design, texture, arrangement, and configuration indicated.
 - 3. Material: ABS Plastic sheet.
 - 4. Provide solid backing and form supports to ensure that form liners remain in place during concrete placement.
 - 5. Use with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface or joint treatments.

2.2 FABRICATION OF FORMS

- A. Make forms sufficiently tight to prevent loss of cement fines. Place chamfer strips in outside corners of forms to produce 45 degree beveled corners on permanently exposed surfaces. Interior corners on such surfaces and edges of formed joints will not require beveling.
- B. To maintain specified finish tolerances, camber formwork to compensate for anticipated formwork deflections prior to hardening of concrete.
- C. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up settlement during concrete placing operation. Securely brace forms against lateral deflection.
- D. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
- E. At construction joints, contact surface of form sheathing for flush surfaces exposed to view shall overlap hardened concrete in previous placement minimum 1 IN. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
- F. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.
- G. Fasten wedges (used for final adjustment of forms prior to concrete placement) in position after final check.
- H. Anchor formwork to shores or other supporting surfaces or members so upward or lateral movement of any part of formwork system is prevented during concrete placement.
- I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

2.3 TOLERANCES

- A. Construct formwork so concrete surfaces will conform to tolerance limits listed: Tolerances non-cumulative. Most restrictive tolerance governs. Tolerance limits noted are maximum deviations (plus or minus) on each side of intended line.
 - 1. Deviation from plumb:
 - a. In lines and surfaces of columns, piers, walls, and in arrises:

- 1) In any length: 1 in 500 but not less than 1/8 IN.
 - 2) In any story: 3/8 IN.
 - 3) Maximum for entire length: 3/4 IN.
 - b. For exposed corner columns, control-joint grooves, and other conspicuous vertical lines:
 - 1) In any length: 1 in 1000 but not less than 1/8 IN.
 - 2) In any story: 3/16 IN.
 - 3) Maximum for entire length: 1/2 IN.
 2. Deviation from level or from grades specified:
 - a. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores:
 - 1) In any length: 1 in 750 but not less than 1/8 IN.
 - 2) In any bay: 3/8 IN.
 - 3) Maximum for entire length: 1/2 IN.
 - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal lines:
 - 1) In any length: 1 in 1000, but not less than 1/8 IN.
 - 2) In any bay: 1/4 IN.
 - 3) Maximum for entire length: 1/2 IN.
 3. Deviations from true plane of concrete surface exposed to view caused by bulging of form facing material between supports:
 - a. 3/16 IN or 1/300 of span between supports whichever is smaller.
 4. Deviation from established position in plan of linear building lines, columns, walls:
 - a. In any length: 1 in 500, but not less than 1/8 IN.
 - b. In any bay: 1/2 IN.
 - c. Maximum for entire length: 3/4 IN.
 5. Deviation in sizes and location of sleeves, floor openings, and wall openings: 1/4 IN.
 6. Deviation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:
 - a. Minus: 1/4 IN.
 - b. Plus: 1/2 IN.
 7. Footings:
 - a. Deviations in dimensions in plan:
 - 1) Minus: 1/2 IN.
 - 2) Plus: 2 IN.
 - b. Misplacement or eccentricity:
 - 1) 2 percent of footing width in direction of misplacement but not more than 2 IN.
 - c. Thickness:
 - 1) Decrease in specified thickness: 5 percent.
 - 2) Increase in specified thickness: No limit (except that which may interfere with other construction).
 8. Deviation in steps:
 - a. In flight of stairs:
 - 1) Rise: 1/8 IN.
 - 2) Tread: 1/4 IN.
 - b. In consecutive steps:
 - 1) Rise: 1/16 IN.
 - 2) Tread: 1/8 IN.
 - c. Deviation from level for any step or landing: 1 in 1000 but not more than 1/8 IN.
- B. Formwork Classifications:
1. Concrete formwork shall meet the following classification requirements:
 - a. Concrete exposed to public view: Class A.
 - b. Concrete exposed to view in back of house areas or to receive membrane waterproofing: Class B.
 - c. Footings: Class D.

- d. All other concrete: Class C.
- C. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items, except where specifically noted otherwise.
- D. Establish and maintain in undisturbed condition and until final completion of project, sufficient control points and bench marks to be used for reference purposes to check tolerances.
- E. Regardless of tolerances listed allow no portion of building to extend beyond property line of project.

PART 3 - EXECUTION

3.1 PREPARATION OF FORM SURFACES

- A. Clean form surfaces and embedded materials of mortar, grout and foreign material before concrete is placed.
- B. Unless otherwise specified or approved, treat surfaces of forms as follows:
 - 1. Before placing of reinforcing steel or concrete, cover surfaces of forms with coating material that will effectively prevent absorption of moisture and prevent bond with concrete, and not stain concrete. A field applied form release agent or sealer or factory applied non-absorptive liner may be used.
 - 2. Do not allow excess form coating material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.

3.2 REMOVAL OF FORMS

- A. When repair of surface defects or finishing is required at early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
- B. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.
- C. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.
- D. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.
- E. Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs and other concrete members in place until concrete has attained its specified strength. Where re-shoring is planned, supporting formwork may be removed when concrete has reached 70 percent of specified strength, provided re-shoring is installed immediately.
- F. When shores and other vertical supports are arranged so non-load-carrying form-facing material may be removed without loosening or disturbing shores and supports, facing material may be removed at earlier age as permitted.

3.3 RE-SHORING

- A. When re-shoring is permitted or required, plan operations in advance. While re-shoring is underway, allow no live load on new construction.
- B. During re-shoring do not subject concrete in beam, slab, column or other structural member to combined dead and construction loads in excess of loads permitted by Architect for developed concrete strength at time of re-shoring. Place re-shores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs. Tighten re-shores to carry required loads without overstressing construction. Leave re-shores in place until:
 - 1. Tests representative of concrete being supported have reached specified strength.

2. In-place concrete is at least 7 days old.
 3. Loads imposed by construction operations do not exceed design loads.
- C. For floors supporting shores under newly placed concrete leave original supporting shores in place or re-shore. Re-shoring system shall have capacity sufficient to resist anticipated loads and equal to at least one half of capacity of shoring system above. Locate re-shores directly under shore position above unless otherwise permitted.
- D. In multi-story buildings extend re-shoring over sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads in such a manner that capacity of floors as determined by design load and developed concrete strength at time of stripping and re-shoring is not exceeded.

3.4 REMOVAL STRENGTH

- A. When removal of formwork or re-shoring is based on concrete reaching specified strength, concrete shall be presumed to have reached this strength when either of following conditions has been met.
1. When test cylinders, field cured along with concrete they represent, have reached specified strength.
 2. When concrete has been cured as specified for same length of time as age at test date of laboratory-cured cylinders which reached specified strength. Determine length of time concrete has been cured in structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of air in contact with concrete is above 50 degF and concrete has been damp or sealed from evaporation and loss of moisture.

END OF SECTION

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SECTION 03 15 23
EXPANSION JOINT SEALS IN CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Expansion Joint Seals In Concrete, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Install Expansion Joints in weather-tight, water-tight fashion.
- B. Extruded Neoprene:
 - 1. Quality complying with ASTM-D3542, and the following properties:

Minimum Physical Properties		
Property	Test Method	Required Value
Tensile strength, min.	ASTM-D412	2000 PSI
Elongation at break, min.	ASTM-D412	250 %
Hardness, Type A durometer	ASTM-D2240	55 ±5
Oven aging (70 hours @ 212° F): Tensile strength, max. Elongation, max. Hardness, Type A durometer	ASTM-D573	20% loss 20% loss 0 to +10 pts
Max Weight Change due to Oil swell; (#3 Oil for 70 hours @ 212° F)	ASTM-D471	45%
Ozone resistance, 20% strain 70 hours aging, ASTM-D573, 3 ppm in air	ASTM-D1149	No cracks

1.3 SUBMITTALS

- A. Project information:
 - 1. Manufacturer of listed products.
- B. Contract Closeout Information:
 - 1. Flood Test Results.
- C. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Expansion joint seals:
 - 1. Base:
 - a. D.S. Brown.
 - 2. Optional:
 - a. Watson Bowman Acme Corp
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 - 1. Size material for joint width(s) indicated and in accord with current published recommendations of manufacturer.
 - 2. Use maximum available lengths.
 - 3. Use factory fabricated joints.
 - 4. Use types described below where indicated:
- B. Expansion Joint Seal – Type A:
 - 1. Description:
 - a. Elastomeric, neoprene profiles as indicated.
 - 2. Base Product(s) (refer to plans for where occurs):
 - a. “JP-Series” by D.S. Brown.
- C. Expansion Joint Seals – Type B:
 - 1. Description:
 - a. Dense neoprene, supported by rolled stainless steel frame rails.
 - b. Frame rails to include 1/2 IN diameter embed studs.
 - 2. Base Product:
 - a. “PG-Series” by D.S. Brown.
- D. Expansion Joint Seals – Type C (Heavy-duty Compression Type):
 - 1. Description:
 - a. Elastomeric, neoprene profiles as indicated.
 - 2. Base Product:
 - a. “Delastic CV-Series” by D.S. Brown.
- E. Expansion Joint Seals – Type D (Normal-duty Compression Type):
 - 1. Description:
 - a. Elastomeric, neoprene honeycomb profiles as indicated.
 - b. Width(s): As indicated
 - 2. Base Product:
 - a. “CS-Series” by D.S. Brown.
- F. Lubricant/adhesive:
 - 1. High-strength, 2-part Epoxy Manufacturer’s standard.
 - 2. Use where required.

2.3 EXPANSION JOINTS TYPES SPECIFIED ELSEWHERE

- A. Expansion Joints at Roofing:
 - 1. Specified in Section 07 62 00 and applicable roofing section(s), or both.
- B. Expansion Joints in Exterior Walls:
 - 1. See Compressible Sealants, Specified in Section 07 92 13.
- C. Expansion Joints in Interior locations:

1. Specified in Section 07 95 13.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Assure that joints to receive seal are free from defects with sides straight and parallel to proper width and depth indicated.
 1. Temperature at time of joint construction determines width of working joint.
 2. Form joints allowing for design temperature variations.
 3. Ensure that concrete is cured per manufacturer's recommendations, prior to installing joint.

3.2 PREPARATION

- A. Clean surfaces to receive seal of material which may be detrimental to effective joint sealing.
- B. Do not apply adhesives at temperatures below 40 DegF.
- C. Do not install seals at temperatures above 85 DegF.
- D. Keep adhesives and solvents away from heat or flame.
- E. Apply in well ventilated area.

3.3 INSTALLATION

- A. General:
 1. Where pedestrian traffic is anticipated: Utilize material which are ADA compliant.
 2. Miter and splice seal at corners where space does not permit a smooth bend.
 3. Splice seal using adhesive to provide a permanent, watertight joint.
 4. Remove misapplied adhesive immediately, using methylethyl ketone (MEK) or toluene.
- B. Installation – Joint Type A, C, and D:
 1. Decompress seals using vacuum suction.
 2. Apply continuous coat of adhesive to both joint interfaces immediately prior to seal installation.
 3. Insert into joint void.
 4. Release suction, allowing material to expand and apply necessary bonding pressure.
 - a. Exception: Use pressurized air, in lieu of suction, where so recommended by manufacturer.
 5. Install with top recessed 1/8 IN.
- C. Installation – Joint Type B:
 1. Embed stainless steel frame rails into concrete.
 2. Coordinate joint void width with drawings and according to manufacturer's recommendations.
 3. Install substantially flush with adjacent slab surfaces.
 4. Seal frame rails to concrete after slabs have cured.

3.4 FIELD TESTING

- A. Flood test installed joints for 24 hours.
 1. Minimum depth of water: 2 IN.
- B. Visually inspect area below for signs of water leakage.
- C. Repair areas which permit passage of water and re-test.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Reinforcing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Testing of reinforcing steel welding shall be performed by Laboratory's testing agency at Laboratory's expense.
- B. Standards:
 - 1. ASTM-A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.
 - 2. ASTM A663: Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
 - 3. ASTM-A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 4. ASTM-A675: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
 - 5. ASTM-A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 6. ASTM-A775: Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - 7. ASTM-A884: Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.
 - 8. ACI 315: Details and Detailing Concrete Reinforcement.
 - 9. American Welding Society ANSI/AWS-D1.4 Structural Welding Code- Reinforcing Steel.
- C. Initial test for reinforcing bar welding will be paid by Laboratory. Retests due to failed initial tests shall be paid by Contractor.

1.3 SUBMITTALS

- A. Shop drawings:
 - 1. Shop drawings indicating size, number, dimensions and locations of reinforcing steel and accessories, in sufficient detail to permit installation of reinforcing without reference to Contract drawings.
 - a. Details of concrete reinforcement and accessories not indicated on Contract Documents shall be in accordance with ACI 315.
 - b. Drawings shall incorporate coordinated sleeve and box out layout drawings provided by mechanical, electrical, plumbing, fire protection and other trades.
- B. Project information:
 - 1. Certification that reinforcing to be welded conforms to ASTM-A706.
- C. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. End bearing splice couplers:
 1. Base:
 - a. Erico Products.
- B. Tension splice couplers:
 1. Base:
 - a. Erico Products.
 - b. Dayton Metal Products.
 - c. Dextra America Inc.
- C. Epoxy adhesive for anchoring reinforcing:
 1. Base:
 - a. Hilti, HIT System.
 2. Optional:
 - a. Simpson, Set
 - b. Powers, Power-Fast
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Reinforcing - General: Conform to ASTM-A615, Grade-60.
- B. Reinforcing - Welded: Reinforcing to be welded shall conform to ASTM-A706.
- C. Welded wire reinforcement: Flat sheets conforming to ASTM-A185 and to wire size and spacing of smooth wire indicated on drawings.
- D. Smooth dowel bars for construction joints: Conform to ASTM-A663 or ASTM-A675, Grade-60. Where indicated, provide a metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section. Provide for movement which equals joint width plus 1/2 IN. Unless otherwise indicated, use 5/8 IN diameter dowels spaced 18 IN on center.
- E. Slab on Grade Plate Dowels: May be used as an equal substitute for smooth dowel bars at construction joints. Plate material shall be ASTM A36 steel and shall be Diamond Dowel System, by PNA Construction Technologies, size 1/4" x 4 1/2 " dowels or equal . Locate plate dowels per smooth dowel bar requirements. Do not shear plates. Remove burrs at edges of plates.
- F. End bearing splice couplers:
 1. Erico Speed-Sleeve Splice by Erico Products.
- G. Tension splice couplers: Shall develop minimum 125 percent of yield strength of bar(s). Where drawings indicate tension splice couplers, provide one of following:
 1. "Lenton" threaded tension coupler by Erico Products.
 2. "Bar-Grip" tension coupler by Dayton Metal Products of Miamisburg, OH.
 3. "Cadweld" tension splice by Erico Products.
 4. Bar-Lock lockshear bolt coupling sleeves, manufactured by Dayton Superior
 5. "Bartec" Mechanical Couplers as manufactured by Dextra America, Inc.

- H. Epoxy coating for reinforcing: Conform to ASTM-A775. Coat reinforcing specifically noted on drawings as well as applicable splice couplers. Touch up damaged coating areas in field.
- I. Epoxy anchored reinforcing: Install reinforcing anchored in concrete with epoxy adhesive, in accordance with epoxy manufacturer's instructions.

2.3 FABRICATION

- A. Bars used for concrete reinforcement shall meet following requirements for fabricating tolerances:
 - 1. Sheared length: Plus or minus 1 IN.
 - 2. Depth of truss bars: Plus 0, minus 1/2 IN.
 - 3. Overall dimensions of stirrups, ties, and spirals: Plus or minus 1/2 IN.
 - 4. Other bends: Plus or minus 1 IN.
- B. For bars with "End Bearing Splice Couplers," bar ends shall terminate in flat surfaces, within 1-1/2 degrees of a right angle to axis of bars and shall be fitted within 3 degrees of full bearing after assembly.

PART 3 - EXECUTION

3.1 WELDING

- A. Perform welding of reinforcing steel in conformance with AWS-D1.4.
- B. Use E70 electrodes.
- C. Each welder shall place an approved identifying mark near each completed weld.
- D. Cut out welds determined to be defective and reweld and retest at Contractor's expense.

3.2 PLACING REINFORCEMENT

- A. Provide minimum concrete covering for reinforcement as follows:
 - 1. Concrete deposited against earth: 3 IN.
 - 2. Formed surfaces exposed to weather or in contact with earth: 2 IN for reinforcing bars No.6 or larger; 1-1/2 IN for reinforcing bars less than No.6.
 - 3. Interior surfaces: 1-1/2 IN for beams, girders, and columns; 3/4 IN for slabs, walls and joists with No.11 bars or smaller, and 1-1/2 IN with No.14 and No.18 bars.
- B. Place bars to following tolerances:
 - 1. Clear distance to formed surfaces: Plus or minus 1/4 IN.
 - 2. Minimum spacing between bars: Minus 1/4 IN.
 - 3. Top bars in slabs and beams:
 - a. Members 8 IN deep or less: Plus or minus 1/4 IN.
 - b. Members between 8 and 24 IN deep: Plus/minus 1/2 IN.
 - c. Members more than 2 FT deep: Plus or minus 1 IN.
 - 4. Crosswise of members: Spaced evenly within 2 IN.
 - 5. Lengthwise of members: Plus or minus 2 IN.
- C. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.
- D. Assure that reinforcement, at time concrete is placed, is free of materials that may adversely affect or reduce bond. Reinforcement with rust, mill scale or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights, including heights of deformations, of a cleaned sample is not less than required by applicable ASTM.

- E. Support reinforcement and fasten together to prevent displacement by construction loads or placing of concrete beyond tolerances indicated. On ground, provide supporting concrete blocks or other approved method. Over formwork, use concrete, metal, plastic or other approved bar chairs and spacers. Where concrete surface will be exposed to weather in finished structure, furnish accessories within 1/2 IN of concrete surface of non-corrosive material or protect against corrosion.
- F. Overlap welded wire reinforcement wherever successive mats or rolls are continuous, in such a way that overlap measured between outermost cross wires of each fabric sheet is not less than spacing of cross wires plus 2 IN. Unless shown otherwise on the drawings, support as required for reinforcing bars by methods of Paragraph E above.
- G. As indicated on drawings, offset vertical bars in columns at least one bar diameter at lapped splices. To ensure proper placement, furnish templates for column vertical bars and dowels.
- H. Splices not specifically indicated shall be subject to approval.
- I. Unless permitted by Architect/Engineer, do not bend reinforcement after embedding in hardened concrete.
- J. Unless permitted by Architect/Engineer, do not tack weld reinforcing.

END OF SECTION

SECTION 03 31 00
CONCRETE MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Materials and Proportioning, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM designated specifications for material quality and test methods appear throughout this specification.
 - 1. The serial designation prefixed with ASTM shall identify the specification which shall be a part of this specification.
- B. Standards for concrete work: Comply with applicable provisions of following ACI publications (latest edition) except as otherwise indicated.
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings."
- C. Concrete Mixture Proportioning:
 - 1. Employ and pay for testing agency acceptable to Architect and Laboratory to perform materials evaluation, testing and design of concrete mixes.
 - 2. Certificates, signed by material producer and Contractor, may be submitted in lieu of material testing when approved by Architect.
- D. Concrete Testing:
 - 1. Specified in Section 03 08 13 (Laboratory Pays).
 - 2. Contractor to assist with related communication and temporary storage of test cylinders at jobsite.
- E. Pre-Concrete Conference
 - 1. At least 35 days prior to the start of the concrete construction schedule, the contractor shall conduct a meeting to discuss the approved mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.
 - 2. The contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
 - a. Architect and/or Engineer
 - b. Contractor's superintendent and quality control representative.
 - c. Laboratory responsible for the concrete design mix
 - d. Laboratorys Testing Agency responsible for field quality control
 - e. Concrete subcontractor
 - f. Ready-mix concrete producer
 - g. Admixture manufacturer(s)
 - h. Concrete pumping equipment manufacturer
 - 3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the Laboratory's representative for information purposes.

4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design, and placing, finishing and curing procedures can produce the concrete quality required by these specifications.

1.3 SUBMITTALS

A. Product Data:

1. Concrete Mix Designs:
 - a. Each Mix design shall be submitted individually. Do not combine multiple mix designs into a single submittal
 - b. Submit the following data for each concrete mix proposed for use:
 - 1) Intended use of the mix design.
 - 2) Proportions of materials.
 - 3) Slump.
 - 4) Air content.
 - 5) 7-day and 28-day compression test results of trial mixes or standard deviation analysis of an established mix. Tests for trial mixes or for use in standard deviation analysis must have been made within 45 days of the date of the submittal. Older results will not be accepted.
 - 6) Test for unit weight of fresh and air dry light weight concrete.
 - 7) Splitting tensile strength ratio for proposed Lightweight Concrete mix(es). Determine in accordance with ASTM-C496.
 - c. Submit source and certification or proof of quality (and compatibility of admixtures) for each of the constituents of the proposed concrete mixes. Compatibility of admixture must be certified.
 - 1) Cement.
 - 2) Aggregate.
 - 3) Water.
 - 4) Admixtures:
 - a) Air Entraining Admixture.
 - b) High-Range Water Reducer.
 - c) Fly Ash.
 - d) Other.
 - d. Review and approval of mix designs by Architect does not relieve the Contractor of responsibility to provide concrete of the quality and strengths required by the Contract Documents.
 - 1) The Architect's approval is contingent upon satisfactory performance and strengths being achieved in the field.

B. LEED Information:

1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lightweight Concrete:

1. Concrete made with low density, lightweight aggregate ASTM-C 330 or mixture of lightweight and normal weight aggregate.
 2. Dry unit weight equal to 15 PCF, plus or minus 3 PCF.
- B. Normal Weight Concrete: Concrete for which density is not a controlled attribute.
1. Materials ultimately used in production must be of same quality, properties and proportion as indicated in approved concrete mix design (as approved by Architect).
- C. Under-slab Vapor Retarder: Specified in Section 03 31 10.
- D. Cement:
1. Portland cement conforming to ASTM-C150 or blended cements conforming to ASTM-C595.
 2. Color: Natural gray.
- E. Aggregates:
1. General:
 - a. Regard fine and coarse aggregates as separate ingredients.
 - b. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of applicable ASTM specifications.
 2. Normal Weight Concrete:
 - a. ASTM-C33, also aggregate shall be obtained from a source approved by the State Highway Department for use in concrete for state bridges.
 3. Lightweight Concrete:
 - a. Coated expanded clay, slate or shale produced by rotary kiln process, conforming to ASTM-C330.
- F. Potable Water:
1. Conforming to ASTM C 1602/C 1602M. Potable
- G. Admixtures:
1. General:
 - a. Use only when specifically required or permitted by Contract Documents, otherwise must be approved by Architect.
 - b. Trial mixes and tests shall be prepared with job materials, including admixture, to demonstrate that there will be no subsequent reduction in strength or durability of hardened concrete.
 - c. Conform to appropriate following specifications:
 2. Calcium chloride and admixtures containing more than 0.05 percent chloride ions are not permitted.
 3. Air-entraining Admixtures: ASTM-C260.
 4. Mid-Range Water Reducer: ASTM-C494, Type A.
 5. High-Range Water Reducer :
 - a. ASTM-C494, Type F or G. Subject to complying with these specifications, the following manufacturers of High Range Water Reducing Admixtures are approved:
 - 1) "Daracem – 100" or Adva Flow Series by Grace Construction Products.
 - 2) "Rheobuild 1000 , Glenium Series or PS 1466 " by BASF Construction Chemicals.
 - 3) "Eucon 37" or "Eucon SPJ" by Euclid Chemical.
 - 4) "PSP-N," "PSP-N2," "PSP-R," and "PSP-L" by Procrete Industries.
 - b. Other manufacturers desiring approval comply with Section 00 26 00.
 6. Water-reducing, Retarding, and Accelerating Admixtures: ASTM-C494.
 7. Supplementary Cementitious Materials:
 - a. Fly ash - ASTM-C618, Class C or Class F.
 - 1) Samples shall be obtained, prepared, and tested in accordance with ASTM-C311.
- H. Concrete Cleaning Solutions:
1. Specified in Section 03 31 10.

2.2 PROPORTIONING CONCRETE MIXES

A. General:

1. Contractor and concrete supplier are responsible to provide concrete, in-place, which satisfies all the requirements listed in the following table.
2. Contractor and concrete supplier are also responsible to adjust the concrete mixes, as needed, to:
 - a. Correct for non-conformance.
 - b. Correct for a variation in the quality of a constituent.
 - c. Compensate for extreme conditions in the field.

- B. Establish concrete material proportions by any of the proportioning methods described in ACI-301 guidelines.

Concrete Properties Table – IP Units							
Use	28-day strength (KSI)	Dry Unit Weight (PCF)	Max Aggregate Size (IN)	Air %	Max. W/C Ratio	Slump (IN)	Cement type
Footings ,Grade Beams	4.0		1-1/2	4.5	0.60	4	I
FDN Walls	4.0		1	4.5	0.50	5	I
Slabs-on-grade	4.0		1-1/2		0.45	3	I
Structural floors, girders, slabs, columns	5.0		3/4		0.45	9(*)	I
Post-tensioned slabs & beams	5.0		3/4 or 1	6	0.40	9(*)	I
Shear Wall	5.0		3/4		0.40	9(*)	I
Lt. Wt. Slabs on composite metal deck	3.5	115	3/4		0.50	6	I
Norm. Wt. Slabs on composite metal deck	4.0		3/4		0.50	6	I
All other uses	4.0		3/4	6	0.50	4	I

C. Instructions for use of Table:

1. General:
 - a. Provide concrete mixes with properties indicated in locations identified in “use” column.
2. 28-day Strength:
 - a. Installed concrete must meet or exceed the minimum 28-day compressive strength indicated.
 - b. Laboratory mix design strengths must exceed this strength by the appropriate amount per ACI-301.
 - c. Determine strength in accordance with ASTM-C192 and ASTM-C39.
3. Dry Unit Weight:
 - a. If no value is listed, assume normal weight.
 - b. Dry unit weight of light weight mixes shall be maximum air dry unit weight permitted.
 - c. Correlate fresh weight with air dry weight of same mix to use as basis of acceptance on job site. Test in accordance with ASTM-C567 and ASTM C 138.
4. Maximum Aggregate Size:
 - a. Maximum size of coarse aggregate determined in accordance with:
 - 1) ASTM-C33 for normal weight concrete.
 - b. Some mixes are designated “3/4 IN or 1 IN,” permitting the contractor / supplier option.
5. Air Content:

- a. Required percentage of entrained and entrapped air as measured by ASTM-C231, ASTM-C173, or ASTM-C138, as appropriate.
 - b. Tolerance of air content as delivered is $\pm 1\text{-}1/2$ percent for normal weight and ± 2 percent for lightweight concrete.
 - c. When left blank, required air content is not specified.
6. Water Reducer:
- a. Mid Range Water Reducer or High Range Water Reducer shall be provided as necessary to achieve slump indicated
 - b. Contractor, as option, may elect to use Water Reducers to improve workability or permit pumping.
7. Maximum W/C Ratio:
- a. Maximum ratio of pounds of water allowed to pounds of cementitious material used in the concrete mix.
8. Slump:
- a. Mixes without Water Reducers:
 - 1) Slump tolerance: Up to 1 IN above maximum indicated is allowed, provided the average of 5 consecutive batches does not exceed the indicated amount by more than a 1/2 IN.
 - b. Mixes with Water Reducers (noted by *):
 - 1) Slump indicated is "after" dosing.
 - 2) Slump tolerance "after" dosing: $+1\text{-}1/2$ IN and -1 IN is permitted for each batch.
 - c. Determine slump in accordance with ASTM-C143.
 - d. Where slump is not specified, provide concrete with slump in accordance with approved mix designs
9. Cement:
- a. Type: Provide cement type indicated.
 - b. As option, the contractor/supplier may use Fly Ash or Ground Blast Furnace Slag for partial replacement of cement.
 - 1) For each unit of cement that is removed, replace with two units of Class F Fly Ash or one unit of Class C Fly Ash.
 - 2) For each unit of cement that is removed, replace with one unit of Ground Blast Furnace Slag
 - 3) Maximum amount of cement replaced shall not exceed that specified in table 4.2.2.9 of ACI 301
 - 4) W/C ratio shall be based on total cementitious material content
- D. Admixtures:
- 1. Use admixtures in accordance with manufacturer's instructions.
 - 2. Use only approved admixtures.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Material Safety Data Sheet and storage labeling shall be available at the job site and conform to current governing regulations.

3.2 STORAGE OF MATERIALS

- A. Store cement in weather tight buildings, bins, or silos which will exclude moisture and contaminants.
- B. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.

1. To insure that this condition is met, perform test for determining conformance to requirements for cleanliness and grading on samples secured from aggregates at point of batching.
 2. Do not use frozen or partially frozen aggregates.
- C. Allow sand to drain until it has reached relatively uniform moisture content before use.
- D. Store admixtures in manner to avoid contamination, evaporation, or damage.
1. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure uniform distribution of ingredients.
 2. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics.

3.3 MIXING AND DELIVERY

- A. Batch, mix and transport concrete in accordance with ASTM-C94.
- B. Batch and mix admixtures in accordance with manufacturer's instructions.
- C. Concrete shall have a slump of 2 to 4 IN when it arrives at job site.
1. Water additions at job site shall be limited to comply with W/C Ratio requirements.
 2. Do not allow water to be added to the mix unless the amount allowed is clearly indicated on the truck delivery ticket.
- D. Following addition of High Range Water Reducer, mix for a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.
- E. Reduction of required average strength:
1. During construction, and after sufficient data becomes available, laboratory strength of mixes may be reduced in accordance with Section 3.11 of AC1-301, subject to approval by the Architect.

END OF SECTION

SECTION 03 31 10
CONCRETE MIXING, PLACING, JOINTING AND CURING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Mixing, Placing, Jointing and Curing as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Materials standards:
 - 1. ASTM-C171: Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM-C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM-C1315: Standard Specification for Liquid Membrane Forming Curing Compounds Having Special Properties for Curing and Sealing Concrete.
 - 4. ASTM-D1751: Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 - 5. ASTM-D1752: Standard specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 6. ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - 7. ASTM E 1745 Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- B. Production standards:
 - 1. ASTM-C94: Standard Specification for Ready-mixed Concrete.
 - 2. ASTM C 138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 3. ASTM-C567: Standard Test Method for Determining the Density of Structural Lightweight Concrete.
 - 4. ACI 305.1: Hot Weather Concreting.
 - 5. ACI 306.1: Cold Weather Concreting.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Vapor Retarder
- B. Shop drawings:
 - 1. Placement plans: Indicate proposed locations of construction joints and placement sequencing.
 - 2. Screeding and finishing plan.
- C. Samples:
 - 1. Joint filler.
 - 2. Vapor Retarder and sealing products.
 - 3. Waterstops.
- D. Project information:
 - 1. Joint filler technical data.
 - 2. Curing compound technical data.
 - a. Interior slabs: Include floor covering manufacturer's writer approval for use.

3. Concrete cleaner.
 4. Waterstop technical data.
- E. Project Closeout Information:
1. Certification of conformance with specified tolerances.
 2. Certification shall be based on documented survey performed by an Illinois Licensed Surveyor employed by the contractor.
 3. Certification shall be submitted within 10 days of completion of the structural concrete frame.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Strippable Curing Compound:
1. Base:
 - a. Kurez DR VOX or Kurez W VOX
 - b. Horncrete WB, Horncrete WB 30 by the Euclid Chemical Company.
- B. Chemical Curing Compound :
1. Base:
 - a. L&M Construction Chemicals.
 2. Optional:
 - a. Dayton Superior.
 - b. Euclid.
 - c. Sonneborne.
 - d. WR Meadows.
- C. Concrete Cleaner:
1. Base:
 - a. ProSoCo.
 2. Optional:
 - a. L&M Construction Chemicals
- D. Self-Expanding Rubber Strip Waterstops:
1. Base:
 - a. Greenstreak.
 2. Optional:
 - a. Progress Unlimited, Inc.
 - b. Deneef Construction Chemicals.
 - c. Adeka (Mitsubishi).
- E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Concrete materials and proportioning: See Section 03 31 00.
- B. Strippable Curing Compound:
1. Conform to ASTM C309 (Voc Compliant, 350 g/l).
 2. For use on slabs receiving subsequent applied finishes and where noted on the drawings.
 3. Install in strict accordance with the manufacturer's recommendation and supervision.
- C. Expansion joint filler, premolded: Type required, conforming to ASTM-D1751 or ASTM-D1752.
1. Curing Sheet Material (required where concrete is scheduled to be stained per section 09 67 75)

- a. Moisture-Retaining Cover Conforming to ASTM C171: A naturally colored, non-woven polypropylene fabric with a 4-mil non-perforated reflective (white) polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention.
- b. Acceptable manufacturers
 - 1) Hydracure M5 by PNA Construction Technologies, Inc., Matthews,
 - 2) Transguard 4000 by Reef Industries (Armorlon Division), Incorporated,

D. Granular Fill: See Section 31 23 00.

2.3 UNDER-SLAB VAPOR RETARDER

- A. Under-slab Vapor Retarder, Class A:
 - 1. Meet ASTM-E1745 Class A and:
 - a. Minimum thickness: 15 mil.
 - b. Maximum Water Vapor Permeance: 0.03 Perm (US).
 - c. Minimum Puncture resistance: 3000 grams ASTM-D1709 Method B.
 - 2. Base Product:
 - a. "Perminator - 15 mil" by WR Meadows.
 - 3. Optional Products:
 - a. Vapor Block 15 by Raven.
 - b. Moistop Ultra 15 by Fortifiber.
 - c. Viper Vaporcheck II 15-mil by Insulation Solutions, Inc.
 - d. "Stego Wrap 15-mil Class A" by Stego.
 - 4. Tape as recommended by vapor retarder manufacturer.

2.4 CONCRETE CLEANERS

A. Base Product: ProSoCo, Sure Klean "Custom Masonry Cleaner".

2.5 WATERSTOPS

- A. Self-Expanding Rubber Strip Waterstops:
 - 1. Bentonite-free hydrophilic polymer modified chloroprene rubber, suitable for adhesive bonding to concrete.
 - 2. Profile: Rectangular or trapezoidal strip unless otherwise indicated.
 - 3. Minimum Dimensions: 3/8 IN x 3/4 IN thick.
 - 4. Provide in maximum practicable length to minimize end joints.
 - 5. Butt splice joints at intersections and at ends of pieces in accordance with manufacturer's instructions.
 - a. Make joints to develop effective watertightness fully equal to that of continuous waterstop material, to permanently develop not less than 50 percent of mechanical strength of parent section, and permanently retain flexibility.
 - 6. Base Products: "Hydrotite" by Greenstreak; "Ultra Seal" by Adeka (Mitsubishi); "Swellseal" by Deneef Construction Chemicals; "Superstop" by Progress Unlimited, Inc

PART 3 - EXECUTION

3.1 MIXING AND PRODUCTION OF CONCRETE

- A. Batch, mix and transport ready-mixed concrete in accord with ASTM-C94.
 - 1. Plant equipment and facilities shall conform to "Check List for Certification of Ready Mixed Concrete Production Facilities" of National Ready Mixed Concrete Association, 900 Spring Street, Silver Spring, MD 20910.
- B. Site batched and mixed concrete will be permitted only after ability to control quality has been demonstrated to satisfaction of Architect.

3.2 MIXING - CONTROL OF ADMIXTURES

- A. Admixtures shall be added in accordance with Manufacturers recommendations
- B. If two or more admixtures are used, verify compatibility with manufacturers

3.3 MIXING - LIGHTWEIGHT CONCRETE

- A. Batch and mix lightweight aggregate concrete as recommended by producer of aggregate.
 - 1. If procedures are recommended which are at variance with these specifications, they must be approved.
- B. If lightweight aggregate absorbs less than 2 percent water by weight within 1 hour, batch and mix concrete based on test of a sample from field-conditioned supply.
- C. If absorption exceeds 2 percent, batch and mix concrete as follows:
 - 1. Add aggregate to approximately 80 percent of mixing water and mix for a minimum of 1-1/2 minutes (15 revolutions in a truck mixer).
 - 2. Then add admixtures, entire weight of cement, and withheld portion of mixing water in order named, and mix.
- D. Base acceptance of lightweight concrete in field on fresh unit weight measured in accordance ASTM-C 138.
 - 1. Nominal fresh unit weight shall be that corresponding to specified maximum air-dry unit weight calculated from formula in ASTM-C567.
 - 2. When nominal fresh unit weight varies more than 2 PCF from required weight, adjust mixture as promptly as conditions will permit to bring unit weight to desired level.
 - 3. Do not allow fresh unit weight of batch to vary more than 3 PCF from desired level.

3.4 MIXING - TEMPERING AND CONTROL OF MIXING WATER

- A. Mix concrete only in quantities for immediate use. Discard concrete which has set.
- B. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded.
 - 1. Incorporate water by additional mixing equal to at least half of total mixing required.
 - 2. Do not add water after discharge commences

3.5 MIXING - WEATHER CONDITIONS

- A. Cold weather:
 - 1. Comply with ACI 306.
 - 2. In cold weather, temperature of concrete when delivered at site shall conform to following limitations:
 - 3. For sections with least dimension greater than 36 IN, comply with table 3.1 of ACI 306R

Minimum Concrete Temperature Required at Time of Pour		
Air Temperature @ time of pour	For sections with least dimension less than 12 IN	For sections with least dimension 12 IN to 36 IN
Above 30 DegF	60 DegF	55 DegF
0 to 30 DegF	65 DegF	60 DegF
Below 0 DegF	70 DegF	65 DegF

Minimum Concrete Temperature Required within 24 Hours of Pour		
Air Temp within 24 Hours of pour	For sections with least dimension less than 12 IN	For sections with least dimension 12 IN or greater
Below 32	60 DegF	50 DegF

4. If water or aggregate is heated above 100 degF, combine water with aggregate in mixer before cement is added.
 - a. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degF.
 - b. Final temperature of combined mix shall not exceed 90 degF or be high enough to cause flash set or loss of slump or workability.
- B. Hot weather:
1. Comply with ACI 305 if high temperature, low slump, flash set, or cold joints are encountered.
 2. Cool ingredients before mixing, or add flake ice or well-crushed ice of a size that will melt completely during mixing for all or part of mixing water. Account for water contribution by ice when calculating the quantity if mixing water and insure that specified W/C ration is not exceeded.

3.6 PREPARATION BEFORE PLACING

- A. Equipment:
1. Remove hardened concrete and foreign material from inner surfaces of conveying equipment.
 2. Provide spare vibrator on job site during concrete placing operations.
 3. In cold weather, have protective blankets ready and heaters operational and in-place before placing concrete.
- B. Forms:
1. Complete formwork: Remove frost, snow, ice, water and foreign material; secure reinforcement in place, position expansion joint material, anchors, and other embedded items and have entire preparation inspected prior to concrete placement.
 2. In hot weather when temperature of reinforcing or forms is greater than 120 degF spray forms and reinforcement with water just prior to placing concrete.
- C. Screeds and screed rails:
1. General:
 - a. Develop a screed system to accurately strike off fresh concrete to the surfaces defined on the drawings.
 - b. Anticipate the deflection of all formwork and support systems. Provide and place extra concrete as necessary to produce finish surfaces with specified tolerances at designated elevations and contours at no additional cost to the Laboratory.
 - c. When form work is cambered whether shored or un-shored and screeding is performed perpendicular (i.e., up and over) to the crown of the camber set screed rails to follow the camber and provide a slab of uniform thickness.
 - 1) When screeding parallel with the camber set one screed at midspan along the crown of the camber and one along the girder or support.
 - 2) Two passes of the screed is necessary to cover one full bay.
 - d. Other screeding methods may be used provided the deflection of un-shored formwork is taken into consideration.
 - e. On unshored steel framing systems, accurately strike off concrete to produce a level surface after steel supporting system has deflected due the dead weight of the fresh concrete. Slab thickness on cambered steel shall not be less than that indicated on plan.
 - f. If not required in the documents and subjected to the approval of the Architect, the Contractor as option may camber the formwork.
 - g. All concrete shall be struck off with a vibrating screed.
 - h. Use of a "wet screed" system will not be permitted unless:
 - 1) The concrete is struck with a pneumatically vibrated "float screed."
 - 2) A highway straight edge is used to true the surface perpendicular to the direction of the screeding.
 - 3) A satisfactory finish is produced on a trial slab.
 - i. Submit a screeding and finishing plan for approval.

- 1) A representative trial slab pour shall be provided to demonstrate that the specified tolerances and a satisfactory surface can be provided by the proposed method of screeding and finishing.
- D. Subgrade for slabs on grade:
1. Subgrade shall be well drained and of adequate and uniform load bearing nature.
 - a. Keep in-place density of subgrade soils at least to minimum indicated.
 2. Keep subgrade free of frost before concrete placing begins.
 - a. If temperature inside a building where concrete is to be placed is below freezing, raise temperature and maintain above 50 degF long enough to remove frost from subgrade and reinforcing.
 3. Keep subgrade moist at time of concreting.
 - a. If necessary, dampen with water in advance of concreting.
 - b. Allow no free water standing on subgrade nor muddy or soft spots when concrete is placed.

3.7 UNDER-SLAB VAPOR RETARDER

- A. Place continuous vapor retarder over granular fill (See Section 31 23 00).
 1. Installation as recommended by manufacturer.
 - a. ASTM-E1643.
 2. Lap vapor retarder at ends and edges of sheets and seal with vapor retarder tape.
 3. Extend to extremities of area.
 4. Turn up at perimeter walls to form bond breaker and tape in place.
 5. Detail sleeved or drilled penetrations as recommended by manufacturer.
 - a. Coordinate detailing at penetrations with subcontractors responsible for penetrations.
- B. Protect vapor retarder. Repair punctures, tears and other damage using vapor retarder tape.
- C. Trim excess material after slab is placed.
- D. Vapor Retarder installation must be approved prior to concrete placement.

3.8 PROTECTION

- A. Unless adequate protection is provided and approval is obtained, do not place concrete when temperature is below freezing or during rain, sleet or snow.
- B. Do not allow rainwater to increase mixing water nor to damage surface finish.
- C. Concrete damaged by rain or weather and judged defective by Architect shall be removed and replaced by Contractor at no additional cost to Laboratory or corrected by procedures listed in Section "Testing and Acceptance."

3.9 CONVEYING

- A. Handle concrete from mixer to place of final deposit as rapidly as practicable by methods which prevent segregation or loss of ingredients and assure that quality is maintained.
- B. Use equipment conforming to ASTM-C94.
- C. Use horizontal belt conveyors or mount at a slope which will not cause excessive segregation or loss of ingredients.
 1. Protect concrete against undue drying or rise in temperature.
 2. Handle to prevent segregation.
 3. Do not allow mortar to adhere to belt.
 4. Discharge long runs into a hopper or through a baffle.
- D. Use metal or metal-lined chutes with slope between 1 vertical and 2-3 horizontal.
 1. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.

- E. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity.
 - 1. Control pneumatic placement so that segregation is not apparent in discharged concrete.
 - 2. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 IN.
 - 3. Do not convey concrete through pipe made of aluminum or aluminum alloy.

3.10 DEPOSITING IN FORMS

- A. Work includes:
 - 1. Deposit concrete continuously or in layers of such thickness that no concrete is deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section.
 - 2. Place at such a rate that concrete which is being integrated with fresh concrete is still plastic.
 - 3. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
 - 4. Remove temporary spreaders in forms when concrete placing has reached an elevation rendering their service unnecessary.
 - 5. They may remain embedded in concrete only if made of metal or concrete and if prior approval has been obtained.
- B. Do not start placing concrete in supported elements until concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.
- C. Deposit concrete as nearly as practicable in its final position to avoid segregation due to re-handling or flowing.
 - 1. Do not subject concrete to procedure which will cause segregation.
 - 2. Concrete shall not drop more than 6 FT unless approved by the Architect/Engineer. For greater heights, provide special mix design, chutes, spouts, tremies, or other approved method.
- D. Concrete buckets shall be equipped with rubber discharge tubes.
 - 1. Tube size shall be effective in directing flow of concrete directly downward between reinforcing.
 - 2. Unless it can be demonstrated, no segregation will occur with greater distances, maximum free fall distance of concrete below flexible tube is limited to 4 FT.
- E. Consolidation:
 - 1. Consolidate concrete by vibration, so that concrete is thoroughly worked around reinforcement, around embedded items and into corners of forms eliminating air or stone pockets which may cause honeycombing, pitting, or planes of weakness.
 - 2. Use internal vibrators having a minimum frequency of 8000 vibrations per minute to consolidate concrete effectively.
 - 3. Do not use vibrators to transport concrete within forms.
 - 4. Insert vibrators and withdraw at points approximately 18 IN apart.
 - 5. At each insertion allow duration sufficient to consolidate concrete but not sufficient to cause segregation; generally from 5 to 15 sec.
 - 6. Where concrete is to have an as-cast finish, bring a full surface of mortar against form by vibration process, supplemented if necessary by spading, to work coarse aggregate back from formed surface.

3.11 SLAB PLACEMENT

- A. Coordinate mixing and placing with finishing.
 - 1. Do not place concrete on subgrade or forms more rapidly than it can be spread, straight edged, and darbled or bull floated.
 - 2. Perform these operations before bleed water has an opportunity to collect on surface.
- B. To obtain good surfaces and avoid cold joints, plan size of finishing crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete.

1. If construction joints become necessary, construct as required under joints and embedded items.
- C. Consolidation:
1. Thoroughly consolidate concrete in slabs.
 2. Use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade.
 3. Obtain consolidation of slabs with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.

3.12 JOINTS AND EMBEDDED ITEMS

- A. Construction joints (other than slab on grade):
1. Locate joints not indicated so as to least impair strength of structure.
 - a. Place joints in locations approved by Architect/Engineer.
 2. In general, locate near middle of spans of slabs, beams, and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice width of beam.
 - a. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings or floor slabs.
 - b. Place beams, girders, brackets, column capitals, haunches, and drop panels at same time as slabs.
 - c. Make joints perpendicular to main reinforcement.
 3. Continue reinforcement across joints.
 4. Clean surface of concrete at joints thoroughly and remove laitance.
 - a. Prior to placing adjoining concrete, dampen (but do not saturate) hardened concrete of construction joints.
- B. Joints in slabs-on-grade:
1. Construction joints:
 - a. Place keyed dowelled or diamond plate construction joints as indicated on plans and at locations where a slab placement is terminated or interrupted.
 - b. Size of placements and sequence of slab placement is Contractor's option, except construction joints shall be located at a control joint location.
 - c. Construction joints act as control joints.
 2. Control joints:
 - a. Provide contraction (control) joints as indicated.
 - b. If not shown, provide along column centerlines.
 - c. Where column centerline spacing or spacing between column centerlines and walls exceeds 30 FT, provide an intermediate joint(s) at intervals not exceeding 30 FT. Locate joints to produce panels that are as square as possible with the length no more than 1.5 times the width
 - d. Also provide joints where change in slab width occurs, such as at block-outs, pits, etc.
 - e. If saw cut joints are required or permitted, time cutting properly with set of concrete by one of the following methods
 - 1) Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw. Complete sawing within 12 hours after placement.
 - 2) The soff cut saw shall be used within two hours of final finishing.
 - a) Cut depth not less than 10 percent of slab thickness with a 1-inch minimum.
 - b) Remove debris in path of cut and under Skid Plate before cutting. Skid Plate must remain flat on surface.
 - c) Use Soff-Cut blades and Skid Plates, using a new Skid Plate with each new blade.
 - d) Install Soff-Cut joint protector at saw-cut intersection prior to cross-cut.
 - e) Remove dry powder without disturbing finish.
 - f) Avoid traffic across saw cut until sufficient strength is gained to protect joint edges.

- 3) If an alternate method or timing is proposed, submit detailed plans for review and acceptance.
3. Complete before shrinkage stresses become sufficient to produce cracking.
4. Isolation joints:
 - a. Provide isolation joints around columns, and between slab on grade and walls.
 - b. Also provide isolation joints around equipment or machinery isolation pads, pits, pipes, etc., unless detailed otherwise.
- C. Expansion joints:
 1. Do not permit reinforcement or other embedded metal items bonded to concrete (except dowels in floors bonded on only one side of joints) to extend continuously through expansion joint.
 2. Locate expansion joints as indicated.
- D. Acoustic Isolation Joint:
 1. Do not permit any reinforcing or other bonded items to extend through joint.
 2. Remove all forming material and clean joint thoroughly prior to cover installation. Locate as indicated.
- E. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to concreting.
 1. Give Contractors whose work is related to concrete or supported by it ample notice and opportunity to introduce and/or furnish embedded items before concrete placement.
 2. Position expansion joint material, waterstops, and other embedded items accurately and support against displacement.
 3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete.

3.13 BONDED JOINTS

- A. At construction joints indicated as bonded, obtain bond by one of following methods:
 1. Roughen surface of concrete in an approved manner which will expose aggregate uniformly and not leave laitance, loosened particles of aggregate or damaged concrete at surface.
 - a. Dampen (but do not saturate) hardened concrete of joints in exposed work; joints in middle of beams, girders, joists, and slabs; and joints in work designed to contain liquids.
 - b. Thoroughly cover with a coat of cement grout of similar proportions to mortar in concrete.
 - c. Use grout as thick as possible on vertical surfaces and at least 1/2 IN thick on horizontal surfaces.
 - d. Place fresh concrete before grout has attained its initial set.
 2. Prepare joints receiving an adhesive and apply adhesive in accordance with manufacturer's recommendations prior to placing of fresh concrete.
 3. Prepare surfaces of joints which have been treated with a chemical retarder in accordance with manufacturer's recommendations prior to placing of fresh concrete.

3.14 SLAB FINISHING

- A. See Section 03 35 00.

3.15 CURING AND PROTECTION

- A. Work includes: Beginning immediately after placement, protect concrete from premature drying, hot or cold temperatures, and mechanical injury, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration and hardening of concrete. Materials and methods of curing subject to approval.
- B. Preservation of Moisture:
 1. Interior Slabs:
 - a. Application of sheet curing materials.

- b. Application of strippable curing compound.
 - 1) Submit written approval from floor covering manufacturer prior to use.
 - 2) Apply in accord with recommendations of manufacturer immediately after water sheen, which may develop after finishing, has disappeared.
 - 3) Apply continuous film at manufacturer's specified rate.
 - 4) Completely remove prior to application of floor covering material.
 - 2. Other concrete surfaces not in contact with forms apply one of following procedures immediately after completion of placement and finishing:
 - a. Ponding or continuous sprinkling.
 - b. Application of absorptive mats or fabric kept continuously wet.
 - c. Application of sand kept continuously wet.
 - d. Continuous application of mist spray (not exceeding 150 degF).
 - e. Application of sheet curing materials.
 - f. Application of other moisture-retaining covering as approved.
 - g. Application of curing compound.
 - 1) Apply in accord with recommendations of manufacturer immediately after water sheen, which may develop after finishing, has disappeared.
 - 2) Apply continuous film at manufacturer's specified rate.
 - 3) Do not use on surface against which additional concrete or other material is to be bonded, unless it is proven that curing compound will not prevent bond or positive measures are taken to remove curing compound completely from areas to receive bonded applications.
 - 3. Minimize moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by sun by keeping forms wet until they can be safely removed.
 - a. After form removal cure concrete until end of time prescribed.
 - 4. Continue curing in accordance with ACI 318 (7 days for most concrete).
 - a. If tests made of cylinders, kept adjacent to structure and cured by same methods, indicate average compressive strength has reached 70 percent of specified strength, (f_c'), moisture retention methods may be terminated.
 - b. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is 1 day old, provided concrete is not permitted to become surface dry during transition.
- C. Temperature, wind and humidity:
- 1. Cold weather:
 - a. When mean daily outdoor temperature is less than 40 degF maintain temperature of concrete between 50 and 70 degF for required curing period.
 - b. When necessary make arrangements for heating, covering, insulating, or housing concrete work adequate to maintain required temperature without injury.
 - c. Do not use combustion heaters during first 24 hours unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
 - 2. Hot weather:
 - a. When necessary make provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
 - b. Take such protective measures as quickly as concrete hardening and finishing operations will allow.
 - 3. Rate of temperature change:
 - a. Keep changes in temperature of air immediately adjacent to concrete during and immediately following curing period as uniform as possible.
 - b. Do not exceed 5 degF in any 1 hour or 50 degF in any 24-hour period.
- D. Protection from mechanical injury:
- 1. During curing period, protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
 - 2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
 - 3. Do not load self-supporting structures in such a way as to overstress concrete.

- E. Protection of slabs-on-grade from frost:
 - 1. Interior slabs exposed to freezing temperatures shall be adequately protected so that frost does not develop in supporting subgrade.

3.16 ELEVATOR DOOR FRAMES

- A. Elevator Door Frames in concrete shafts:
 - 1. Block-out as required by Elevator Manufacturer to allow for door frames to be set.
 - 2. After door frames have been set, set forms across void between frame and edge of block-out.
 - 3. Fill in with concrete fill.

3.17 CONCRETE CLEANING

- A. Clean all Cast-in-Place concrete walls which will remain exposed to view.
 - 1. Including walls which are scheduled for painting.
 - 2. Areas:
 - a. Exposed exterior concrete columns at First Floor.
 - b. Exposed exterior concrete wall supporting west end of Second Floor terrace at northwest corner of the building.

END OF SECTION

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SECTION 03 35 00
CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Finishing and Repair of Surface Defects, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Floor finish tolerances:
 - 1. Follow F-Number System as defined in ASTM-E1155.
 - a. Floor Flatness F-Number: Ff defines maximum floor curvature allowed over 24 IN computed on basis of successive 12 IN elevation differentials.
 - b. Floor Levelness F-Number: Fl defines relative conformity of floor surface to a horizontal plane measured over a 10 FT distance.
 - c. Above number pair to be stated in form: Ff/Fl.
 - d. Specified overall value is enumerated and is based on composite of all measured values in a placement.
 - e. Minimum local value (MLV) describes flatness or levelness below which repair or replacement is required. MLV is based on individual placement and applies to minimum local area not crossing construction or control joints.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bonding agent: Approximately one (1) part Portland cement to one (1) part fine sand passing a No.30 mesh sieve. Mix to consistency of thick cream.
- B. Patching compound: Same materials and approximately same proportions as used for concrete, except omit coarse aggregate. Shall consist of not more than one (1) part Portland cement to two and one half (2-1/2) parts sand loose volume. For exposed concrete, part of Portland cement shall be white to produce a color matching color of surrounding concrete, as determined by a trial patch. Add no more water than necessary for handling and placing. Mix compound in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest consistency that will permit placing.
- C. Grout for grout cleaned rubbed finish: Mix one (1) part Portland cement and one and one-half (1-1/2) parts fine sand with sufficient water to produce a grout with a consistency of thick paint.
- D. Grout for cork floated rubbed finish: Mix one (1) part Portland cement and one (1) part fine sand with sufficient water to produce a stiff grout.
- E. Proprietary materials: At Contractor's option, proprietary compounds for adhesion, patching, or finishing may be used in lieu of or in addition to foregoing grouts. Use such compounds in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 FINISHING - GENERAL

- A. After removal of forms, repair and give surfaces of concrete finishes indicated.
 - 1. Top surface of slabs not included.
- B. Unspecified finish: If finish is not designated, use following finishes as applicable:
 - 1. Unpainted concrete surfaces not exposed to public view: Rough form finish.
 - 2. Unpainted concrete surfaces exposed to public view: Smooth form finish.
 - 3. Concrete surfaces to receive paint: Grout cleaned rubbed finish.
 - 4. Unformed surfaces (except slabs): As indicated.
 - 5. Concrete surfaces to be waterproofed in Section 07 14 13 and Section 07 14 16: Smooth form finish.

3.2 REPAIR OF SURFACE DEFECTS

- A. Repair surface defects immediately after form removal. Remove honeycombed and other defective concrete down to sound concrete. Chip if necessary to make edges perpendicular to surface or slightly undercut. No feather edges will be permitted. Dampen area to be patched and an area at least 6 IN wide surrounding it to prevent absorption of water from patching compound. After surface water has evaporated from area to be patched, brush bonding agent into surface. When bonding agent begins to lose water sheen, apply patching compound. Thoroughly consolidate compound into place and strike off so as to leave patch slightly higher than surrounding surface. To permit initial shrinkage, leave undisturbed for at least 1 HR before final finish. Keep patched area damp for 7 days. Do not use metal tools in finishing a patch which will be exposed.
- B. Tie holes: Unless stainless steel, non-corrosive, or acceptably coated ties are used, tie holes shall be filled. Clean and thoroughly dampen tie holes; fill solid with patching compound.

3.3 AS-CAST FINISHES

- A. Rough form finish: No selected form facing materials are specified for rough form finish surfaces. Concrete surfaces must conform to tolerances in Section 03 11 00 "Concrete Formwork." Patch defects and tie holes. Chip or ruboff fins exceeding 1/4 IN in height. Otherwise, leave surfaces with texture imparted by forms.
- B. Smooth form finish: Use form facing material to produce a smooth, hard, uniform texture on concrete. It may be plastic coated plywood, metal, plastic liners, or other approved material capable of producing desired finish. Arrange facing material orderly and symmetrical, with number of seams kept to practical minimum. Support by studs or other backing capable of preventing excessive deflection. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.
 - 1. Patch tie holes and defects. Remove fins completely.
 - 2. When surface texture is impaired and form joints misaligned by more than 1/8 IN grind bushhammer, or correct affected concrete as directed by Architect. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete. Repair major mortar leakage as a defective area.
- C. Finishing of related unformed surfaces: (Except Slabs).
 - 1. Strike smooth tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
 - 2. Float to a texture reasonably consistent with that of formed surfaces.
 - 3. Continue final treatment on formed surfaces uniformly across unformed surfaces.

3.4 RUBBED FINISHES

- A. General: Form and repair concrete surfaces to receive rubbed finishes, in accordance with requirements for smooth form finish. Remove forms and perform necessary patching as soon after placement as possible without jeopardizing structure.
- B. Smooth: Produce smooth rubbed finish on newly hardened concrete no later than day following form removal. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced. Use no cement grout other than cement paste drawn from concrete itself by rubbing process.
- C. Grout cleaned: Undertake no cleaning operations until contiguous surfaces are completed and accessible. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly. Immediately after applying grout, scrub surface vigorously with a cork float or stone to coat surface and fill air bubbles and holes. While grout is still plastic, remove excess grout by working surface with a rubber float, sack, or other means. After surface whitens from drying, rub vigorously with clean burlap. Keep finish damp for at least 36 hours after final rubbing.
- D. Cork floated: Remove forms at an early stage, within 2 to 3 days of placement where possible. Remove ties. Remove burrs and fins. Dampen wall surface. Apply grout with firm rubber float or with trowel, filling surface voids. Compress grout into voids. If grout surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with a fog sprayer. Produce final texture with a cork float using a swirling motion.

3.5 SLAB FINISHING

- A. General:
 - 1. Place slabs to finish tolerances specified.
 - 2. Slab finish: Use following finishes at building locations noted.
 - a. Scratched finish: Surfaces intended to receive bonded applied cementitious applications, such as setting beds, grout, etc.
 - b. Floated finish (magnesium):
 - 1) Surfaces intended to receive roofing, waterproofing membranes, or sand bed terrazzo.
 - 2) Surfaces of ramps, docks, stairs in which no other covering is specified.
 - c. Troweled finish:
 - 1) Floors intended as walking surfaces or to receive floor coverings.
 - d. Non-slip finish (interior and exterior): Ramps, docks, stairs specifically noted on drawings.
- B. Finishing tolerances:
 - 1. For shored construction, measurements for conformance with finishing tolerances shall be made as soon as slab can tolerate foot traffic, and before shores are removed.
 - 2. The Fl levelness tolerance is not applicable to unshored form work such as cast in place topping on prestressed tees, slabs on unshored steel and metal deck, or unshored-postensioned slabs on steel beams.
 - 3. Horizontal finishes will be accepted provided:
 - a. Applicable specification requirements are satisfied.
 - b. Water does not pond in areas sloped to drain.
 - c. Floor finish tolerances Ff/Fl conforms to that specified for particular finish and minimum local valves are not less than 75 percent of the floor finish tolerance specified.
 - 4. Accumulated deviation from intended true plane of finished surface does not exceed 1 IN.
 - 5. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items or items fitted to floor (doors, tracks, etc.).
- C. Finishes:

1. Scratched finish: After concrete has been placed, consolidated, struck off, and leveled to a Ff15/FI13 tolerance, roughen surface with stiff brushes or rakes before final set.
2. Floated finish: After concrete has been placed, consolidated, struck off, and leveled, do not work further until ready for floating. Using a magnesium float, begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles. Cut down high spots and fill low spots during this procedure to produce a surface within Ff20/FI15 tolerance throughout. Refloat slab immediately to a uniform sandy texture.
3. Troweled finish: First float-finish surface. Next power trowel, and finally hand trowel. First troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still indicate some trowel marks. Perform additional trowelings by hand after surface has hardened sufficiently. Final trowel when a ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Ff25/FI20 tolerance. On surfaces intended to receive floor coverings, grind off defects which would indicate through floor covering. On surfaces intended to receive waterproofing membranes grind off defects that might tear or otherwise damage membrane.
4. Broom or belt finish: Immediately after concrete has received float finish, give it a coarse scored texture by drawing a broom or burlap belt across surface transverse to slope or traffic flow.
5. Non-slip slab finish:
 - a. Aggregate: Crushed ceramically bonded aluminum oxide particles. Apply at 25 LB per 100 SF.
 - b. Blend aggregate with Portland cement in proportions recommended by manufacturer of aggregate.
 - c. Give surface a float finish.
 - d. Apply approximately two-thirds of blended material for required coverage to surface by a method that ensures even coverage without segregation. Begin floating immediately.
 - e. After material has been embedded by floating, apply remainder of blended material to surface at right angles to previous application. Make second application heavier in areas not sufficiently covered by first application. Follow with second floating immediately.
 - f. After selected material has been embedded by two floatings, complete operation with a broomed finish.

END OF SECTION

SECTION 03 38 16
POST-TENSIONED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Post-Tensioned Concrete, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Standards for post-tensioned concrete work:
 - 1. ACI 318: Building Code Requirements for Reinforced Concrete Work.
 - 2. "Specification for Unbonded Single Strand Tendons" as published by the Prestressed Concrete Institute, latest edition.
 - 3. "Guide Specification for Post-Tensioning Materials" as published by Post-Tensioning Institute, latest issue.
- B. Post-tension work shall involve a post-tensioning specialty contractor (P-T organization) that specializes in post-tensioning. The P-T organization shall have successfully performed five previous installations of unbonded tendons in buildings similar to the one involved in this contract. Subject to compliance with specifications, following firms are approved for use:
 - 1. VSL Corporation; 925 Tollgate Road; Elgin Illinois.
 - 2. Amsysco, Inc.: 1200 Windham Parkway; Romeoville Illinois.
 - 3. Other firms desiring approval shall comply with Section 00 26 00 and 102-E.
- C. Duties of P-T Organization.
 - 1. Retain a registered Structural Engineer experienced in post-tensioned concrete design to:
 - a. Review Contract Documents for items at variance with established post-tensioned procedures and/or ACI 318. Submit variances to Architect/Engineer not less than 10 days before bids are received. Variance not submitted before such date shall be corrected by Post-Tension Contractor or resolved to satisfaction of Engineer without increase in Contract Price.
 - b. Compute prestress losses in accordance with latest recommendations of ACI/ASCE Joint Committee 423. Conduct Tendon and anchorage testing if necessary.
 - c. Provide design calculations in accordance with the codes and standards set forth here in. At post-tensioning anchor points, provide reinforcing in addition to that noted on the drawings if required by the design calculations.
 - d. Prepare and place requested information on shop drawings.
 - e. Seal and sign shop drawings and calculations.
 - 2. Before start of work, meet with Contractor to establish complete sequence and schedule of concrete placement and post-tensioning work. Coordinate construction joints, stressing points, intermediate stressing points and dead end locations.
 - 3. Provide a trained, skilled, experienced full-time representative, approved by the Architect/Engineer, to be present during work to insure that the installation and prestressing operations are conducted in compliance with the contract documents.
- D. The P-T Organization shall have a qualified registered Structural Engineer who has been on organization's staff a minimum of five years certify that product conforms in aspects to the requirements of ACI-318.
- E. Any P-T Organization not previously approved shall submit the following to the Engineer for approval not less than 14 calendar days prior to bid date.

1. List of projects described in 1.02-B above.
2. Details of anchorages as described in Section 2.01-C.2.
3. Sample of slab and beam tendons (12 IN minimum length).
4. Quality plan for the manufacture and installation of the post-tensioning system.
5. Prior to the bid, written approval must be received from the Engineer in order for P-T Organization to bid. The Engineer shall grant approval based on compliance with the specified criteria referenced herein. The Engineer's decision is final. Proposals from unapproved P-T Organizations will be rejected at the shop drawing approval stage and any delays due to such rejection shall be the responsibility of the Contractor.

1.3 SUBMITTALS

- A. Product data:
 1. Test data on anchorage devices.
- B. Shop drawings:
 1. Prepare sufficient detail to permit prestressing steel and accessories to be placed without reference to Contract Documents. Provide following information in addition to that required by applicable provisions of Section 03 11 00 Formwork and Section 03 20 00 Reinforcement.
 - a. Locations of Tendons throughout their length.
 - b. Size, details, location, materials and stress grade (where applicable) for tendons and accessories.
 - c. Stressing sequence, initial tensioning forces, gauge pressures, and tendon elongation.
 - d. Initial and final strand stresses.
 - e. Details at beam and slab strand anchorage locations which have been coordinated with, and indicate location of, mild reinforcement.
 - f. Clearances required by stressing.
 2. Calculations to indicate that the anchorage details for beams shown on the shop drawings comply with the code and standards specified.
 3. Calculations of losses, indicating final effective prestress force equal to or greater than the design requirements.
 4. Once approved, no changes or deviations from shop drawings shall be permitted without the approval of the engineer. Shop drawings shall bear the signature and seal of the P-T Organizations Structural Engineer.
- C. Project information:
 1. Stressing Equipment Calibration Charts:
 - a. Calibration charts shall be submitted for each set of stressing equipment.
 2. Calibration charts indicating that sets of equipment (ram and gauge) to be used on the jobsite are calibrated such that the gauge pressure required to stress the tendons to the desired force is identical regardless of the set of equipment being used.
 3. Record tendon drawings and stressing records.
- D. LEED Information:
 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete materials: See Section 03 31 00.
- B. Reinforcement, conventional: See Section 03 20 00.
- C. Prestressing assembly:
 - 1. Comply with requirements of "Specification for Unbonded Single Strand Tendon," including provisions for protecting assembly in corrosive environments. Provide complete protective, sealed, encapsulation of prestressing assembly.
 - a. Prestressing Steel:
 - 1) Prestressing steel used in single strand unbonded post-tensioning tendons shall conform to ASTM-A416 270k, or Low Relaxation Type.
 - 2) Certified Mill Test Reports shall be furnished upon request for each coil or pack of strand, containing as a minimum the following test information:
 - a) Heat number and identification.
 - b) Standard chemical analysis for heat of steel.
 - c) Ultimate tensile strength.
 - d) Yield strength at 1% extension under load.
 - e) Elongation at failure.
 - f) Modulus of elasticity.
 - g) Diameter and net area of the strand.
 - h) Type of material (low relaxation).
 - 3) Relaxation losses for low relaxation type material shall be based on relaxation tests of representative samples for a period of 1000 hours, when tested at 70 DegF and stressed initially to not less than 70% of the minimum guaranteed breaking strength of the strand.
 - 4) Low relaxation strand shall be provided with a mill applied continuous permanent physical marking to permit field identification.
 - 5) The material shall be packaged at the source in a manner which prevents physical damage to the strand during transportation and protects the material from deleterious corrosion during transit and storage.
 - b. Anchorages and Couplings:
 - 1) Tendon anchorages and couplings shall be designed to develop the static and dynamic strength requirements of Section 3.1.3-1 and Sections 3.1.8-1 and 2 of the PTI "Guide Specifications for Post-Tensioning Materials." Castings shall be nonporous and free of sand, blow holes, voids and other defects.
 - 2) The average compressive concrete bearing stress of anchorages shall not exceed the limits set forth in Section 3.1.7 of the PTI "Guide Specifications for Post-Tensioning Materials."
 - 3) For wedge type anchorages, the wedge grippers shall be designed to preclude premature failure of the prestressing steel due to notch or pinching effects under the static and/or dynamic test load conditions stipulated under Part 1, for both stress relieved and low relaxation prestressing steel materials.
 - 4) Couplings shall be used only at locations specifically indicated on the shop drawings or as approved. Couplings shall be coated with the same corrosion preventative coating used on the strand and shall be enclosed in sleeves which permit necessary movements during stressing.
 - 5) Anchorages shall include design features permitting a watertight connection of the sheathing to the anchorage, and watertight closing of the wedge cavity, for stressing and non-stressing (fixed) anchorages. Intermediate stressing anchorages shall be designed to permit complete watertight encapsulation of the prestressing steel.

- c. Sheathing:
 - 1) The tendon sheathing for unbonded single strand tendons shall be made of a material with the following properties:
 - a) Sufficient strength to withstand unrepairable damage during fabrication, transport, installation, concrete placement and tensioning.
 - b) Watertightness over the entire sheathing length.
 - c) Chemical stability, without embrittlement or softening over the anticipated exposure temperature range of 100 DegF.
 - d) Non reactive with concrete, steel and the tendon corrosion preventive coating.
 - 2) Minimum thickness of the sheathing shall not be less than 0.040 IN for medium or high density polyethylene or polypropylene.
 - 3) The sheathing shall have an inside diameter at least 0.010 IN greater than the maximum diameter of the strand.
 - 4) The sheathing shall be connected to stressing, intermediate and fixed anchorages in a watertight fashion, thus providing a complete encapsulation of the prestressing steel.
- d. Corrosion Preventive Coating:
 - 1) The corrosion preventive coating material shall have the following properties:
 - a) Provide corrosion protection to the prestressing steel.
 - b) Provide lubrication between the strand and the sheathing.
 - c) Resist flow from the sheathing within the anticipated temperature range of the exposure.
 - d) Provide a continuous non-brittle film at minus 40 DegF.
 - e) Chemically stable and non-reactive with the prestressing steel, the sheathing material, and the concrete.
 - 2) The film shall be an organic coating with appropriate polar, moisture displacing and corrosion preventive additives.
 - 3) Minimum weight of coating material on the prestressing strand:
 - a) Not less than 2.5 LBS of coating material per 100 FT of 0.5 IN diameter strand.
 - b) Not less than 3.0 LBS of coating material per 100 FT of 0.6 IN diameter strand.
 - c) The amount of coating material used shall be sufficient to ensure essentially complete filling the annular space between the strand and the sheathing.
 - d) The coating shall extend over the entire tendon length.
 - 4) Test results in accordance with Table 3.2.1 of the Specification for Unbonded Single Strand Tendons shall be provided for the corrosion preventive coating material.

2.2 FABRICATION OF FORMWORK

- A. See Section 03 11 00.
- B. Use formwork which does not restrain elastic shortening, deflection, or camber resulting from application of prestressing force.
- C. Do not remove from supports until sufficient prestressing force has been applied to support dead load, formwork, and anticipated construction loads.
- D. Make formwork sufficiently rigid to prevent displacement of tendons beyond tolerances indicated.

PART 3 - EXECUTION

3.1 CONCRETE WORK

- A. Specified in Section 03 31 10 and Section 03 35 00.

3.2 INSTALLATION OF PRESTRESSING ASSEMBLIES

A. General:

1. Prestressing tendons shall be firmly supported at intervals not exceeding 4 FT to prevent displacement during concrete placement.
2. The tendons shall not be exposed to excessive temperatures, welding sparks or electric ground currents.

B. Stressing Anchorages:

1. Stressing anchorages shall be installed perpendicular to the tendon axis. Curvature in the tendon profile shall preferably not be closer than 3 FT from the stressing anchorage.
2. Stressing anchorages shall be attached to the bulkhead forms by either bolts, nails, or threaded pocket former fittings. The connections shall be sufficiently rigid to avoid accidental loosening due to construction traffic or during concrete placement. Minimum concrete cover for the anchorage shall not be less than the minimum cover to the reinforcement at other locations in the structure.
3. Pocket formers used to provide a void form at stressing and intermediate stressing anchorages shall positively preclude intrusion of concrete or cement paste into the wedge cavity during concrete placement. The depth of the pocket former from the edge of the concrete to the face of the anchorage shall not be less than 2 IN.

C. Fixed Anchorages:

1. Fixed end anchorages shall be installed on the tendon at the suppliers plant prior to shipment to the job site.
2. For wedge type anchorages, the fixed end wedges shall be seated, with a load of not more than 80% of the minimum ultimate tensile strength of the tendon for stress relieved strand or for low relaxation strand. The seating load shall be sufficient to ensure adequate capacity of non-stressing anchorages.
3. Fixed end anchorages shall be placed in the formwork at the locations shown on the placing drawings, and securely fastened to the reinforcing steel. Minimum cover requirements of stressing anchorages apply to fixed end anchorages.
4. Fixed end anchorages shall be closed or capped at the wedge cavity side with a watertight cover. This cover shall preferably be shop installed, after filling the void around the wedge grips with corrosion preventive coating material comparable to that used as a corrosion preventive coating over the length of the tendon.

D. Sheathing Inspection:

1. After installing the tendons in the forms and prior to concrete casting, the sheathing shall be inspected for possible damage.
2. Damaged areas shall be repaired by restoring the corrosion preventive coating in the damaged area, and repairing the sheathing. Repairs of sheathing shall be watertight, and must be approved by the Engineer of Record.
3. Tape used to repair sheathing shall be adhesive moisture proof tape, spirally wrapped around the tendon to provide at least two layers of tape.

E. Tendon Placement Tolerances:

1. Concrete Dimension: Location tolerance.
 - a. 8 IN or less: Plus/minus 1/4 IN.
 - b. 8 to 24 IN: Plus/minus 3/8 IN.
 - c. 24 IN or greater: Plus/minus 1/2 IN.
2. Tolerances is in same direction as dimension.

3. Tolerance applies separately in vertical and horizontal direction.
 4. Unless established otherwise, horizontal tolerances for tendons in slabs shall be plus/minus 2 IN.
- F. Bundle strands only as indicated on approved Shop Drawings.

3.3 TENDON STRESSING

- A. Stress concrete within 96 hours after placement; however, do not stress concrete until field cured concrete cylinder tests (2 cylinders minimum) indicate concrete strength has reach 3,500 PSI.
- B. Hydraulic stressing rams used to stress unbonded single strand tendons shall be equipped with stressing grippers which will not notch the strand more severely than normal anchoring wedges.
- C. Stressing rams and gauges shall individually be identified and calibrated against known standards at intervals not exceeding six months. Calibration certificates for each jack used shall be available upon request.
- D. Elongation measurements shall be made at each stressing location to verify that the tendon force has been properly achieved. Measured elongations shall agree with calculated elongations within +/- 5%. Discrepancies exceeding +/- 5% shall be resolved with the Designer/Engineer of Record.
- E. Stressing records shall be filled out during the tensioning operation, with the following data recorded as a minimum:
 1. Tendon mark or identification.
 2. Required elongation.
 3. Gauge pressure to achieve required elongation.
 4. Actual elongation achieved.
 5. Date of stressing operation.
 6. Signature of the stressing operator or inspector.
 7. Serial or identification number of jacking equipment. Stressing records shall be turned over to the Laboratory or their representative for verification and safekeeping.
- F. Stressing record approval
 1. Prior to cutting any tendon tails, the contractor shall submit stressing records to both the P-T Organization and the Structural Engineer of Record for review.
 2. The P-T Organization shall review the stressing records and make recommendations necessary regarding tendon elongations not within specified limits
 3. After approval of the final stressing records by the P-T Organization, the P-T Organization shall submit certification that the required post-tension forces were transferred in accordance with the contract documents.
 4. Cut tails and grout pockets only after required stressing records and certifications have been submitted and accepted.
- G. Tendon Finishing:
 1. Trimming of excess tendon length. As soon as possible after tendon tensioning and satisfactory check of elongation, the excess tendon length shall be cut. The tendon length protruding beyond the wedges after cutting shall be between 0.75 and 1.25 IN. The tendon may be cut by means of either oxyacetylene cutting, abrasive wheel or hydraulic shears. In case of oxyacetylene cutting of the tendon, care shall be taken to avoid directing the flame toward the wedges.
 2. Stressing pockets shall be filled with non shrink mortar as soon as practical after tendon stressing and cutting. Under no circumstances shall the grout or mortar used for pocket filling contain chlorides or other chemicals known to be deleterious to the prestressing steel. The exposed strand and wedge areas shall be coated with tendon coating material comparable to that used over the length of the tendon and a watertight cap shall be applied over the coated area. Prior to installing the pocket mortar, the inside concrete surfaces of the pocket shall be coated or sprayed with a resin bonding agent.

3. Rub exposed to view pockets after filling with grout with carborundum stone until patched area blends and matches surrounding surface.

3.4 MARKING AND RECORD TENDON DRAWINGS

- A. Marking of strand locations in slabs: Indicate location of post-tensioning strands with a permanent marker visible from underside of slabs. Place approved markers indicating strand direction in forms prior to placement of concrete. Place markers near column centerlines. If span exceeds 20 FT, place an additional marker at midspan.
- B. Keep up to date tendon record drawings indicating exact location of tendons and anchorages. Provide complete set of sepia record prestressing steel shop drawings to Architect/Engineer after post tensioning operations are complete.

END OF SECTION

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SECTION 04 05 05
COLD AND HOT WEATHER MASONRY PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Cold and Hot Weather Masonry Procedures, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. As required to achieve desired results.

PART 3 - EXECUTION

3.1 PROCEDURES

- A. International Building Code, Chapter 21.
- B. Local Building Code.
- C. ACI 530.1/ASCE 6/TMS 602.
- D. Brick Industry Association, Technical Note 1.
- E. National Concrete Masonry Construction, Technical Note 3-1C.

3.2 GENERAL

- A. At end of each day or at shutdown, cover tops of walls not enclosed or sheltered.
- B. Do not use frozen or ice coated materials.
- C. Remove and replace frozen or damaged masonry to satisfaction of Architect.

3.3 TEMPORARY FACILITIES

- A. Construct and maintain temporary protection required to permit continuous and orderly progress of work.
- B. Provide temperature conditioning sufficient for indicated temperatures.
- C. Provide sufficient temporary lighting to permit work to be correctly performed.

END OF SECTION

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SECTION 04 05 10
MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Masonry Cleaning, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Project information:
 - 1. Name of proposed product and manufacturer.
 - 2. Certification that the proposed product(s) are compatible for materials on subject project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Cleaners:
 - 1. Base:
 - a. ProSoCo.
 - 2. Optional:
 - a. EaCo Chem.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 - 1. Do not use products which are not recommended by manufacturer of material to be cleaned.
- B. Brick Masonry cleaner:
 - 1. Red Brick:
 - a. Base Product: "Sure Klean Lime Solvent 101" by ProSoCo.
- C. Concrete Masonry (CMU) Cleaners:
 - 1. General:
 - a. Clean all CMU which will remain exposed to view (including CMU walls which are scheduled for painting).
 - 2. Lightweight and Normal Weight CMU:
 - a. Base Product: "Sure Klean Custom Masonry Cleaner" by ProSoCo.
- D. Cast-in-Place Concrete Cleaner:
 - 1. General:
 - a. Clean all Cast-in-Place concrete walls which will remain exposed to view (including CIP walls which are scheduled for painting).
 - b. Clean with most effective products which are appropriate for texture(s) and color(s) specified.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces to be cleaned.
 - 1. If necessary point with mortar.
- B. Waiting Time before cleaning:
 - 1. Mortar Types N and O: Allow mortar to cure for 14 to 28 days prior to cleaning.
 - 2. Mortar Types M and S: Allow mortar to cure for 7 to 14 days prior to cleaning.
 - 3. Colored Mortar, all strengths: Allow mortar to fully cure 28 days prior to cleaning.
- C. Remove excess mortar using wooden paddles and scrapers.
- D. Do not proceed with cleaning until unsatisfactory conditions have been corrected.
- E. Test 4 x 4 FT area of each surface type for compatibility with cleaner, using recommended dilutions, prior to full scale cleaning operations.
- F. Cleaning indicates acceptance of surfaces and responsibility for performance.

3.2 PREPARATION

- A. Protect adjacent surfaces, not scheduled for cleaning.
- B. Prepare surfaces as recommended by manufacturer.

3.3 CLEANING

- A. Clean surfaces as recommended by manufacturer.
- B. Do not use wire brushes.
- C. If metal tools are used, use only tools free of rust.
- D. Thoroughly rinse and pre-soak walls.
- E. Flush loose mortar and dirt from surface.
- F. Wet to prevent "runoff" streaking.
- G. Apply solution using fibered wall washing brush or low-pressure spray.
 - 1. Maximum Pressure: not to exceed 400 PSI.
 - 2. Tip spray angle: Not less than 25 Degrees.
 - 3. Maximum rate of flow: 4 to 6 GPM.
 - 4. Tip shall be held at least 12 IN from surface of masonry.
 - 5. Comply with manufacturer's recommendations, where more restrictive.
- H. Scrape off mortar and re-apply cleaning solution.
- I. After scrubbing, clean thoroughly with low pressure water.
 - 1. Comply with low-pressure spray criteria listed above.

END OF SECTION

SECTION 04 05 13
PORTLAND CEMENT-LINE (PCL) MORTARS & GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Portland Cement-Lime (PCL) Mortars & Grout, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Materials standards:
 - 1. ASTM-C143 Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - 2. ASTM-C144 Standard Specification for Aggregate for Masonry Mortar.
 - 3. ASTM-C150 Standard Specification for Portland Cement.
 - 4. ASTM-C207 Standard Specification for Hydrated Lime for Masonry Purposes.
 - 5. ASTM C270 Specification for Unit Masonry.
 - 6. ASTM-C404 Standard Specification for Aggregates for Masonry Grout.
 - 7. ASTM C476 Standard Specification for Grout for Masonry.
 - 8. ACI 530.1 Building Code Requirements and Specification for Masonry Structures.
 - 9. Brick Institute of America.
- B. Cold Weather Procedure: Specified in Section 04 05 05.
- C. Hot Weather Procedures:
 - 1. When ambient temperature is over 100 DegF, or over 90 DegF with a wind over 8 MPH:
 - a. Monitor mortar temperature and maintain it between 70 to 120 DegF.
 - b. Limit spreading of bed mortar to 4 FT, maximum, and place masonry units within 1 minute of spreading.
- D. Definitions:
 - 1. PCL Mortar: Portland Cement-Lime Mortar.
 - 2. PCL Grout: Portland Cement-Lime Grout.
 - 3. The use of masonry cement alone, or in combination with and PCL mixes, is prohibited.
 - 4. Factory Pre-Blended: Factory blend all mortar mix dry ingredients including; sand, cement, lime, pigments, etc.

1.3 SUBMITTALS

- A. Project Information:
 - a. Planned cold weather construction procedures.
 - b. Planned hot weather construction procedures.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Factory Pre-blended PCL Mortar:
 - 1. Base:
 - a. Spec Mix.
 - 2. Optional:
 - a. ProMix (U-mix).
 - b. Quickcrete.

- c. ProSpec (Bonsal).
- B. Site-Mixed PCL Grout:
 - 1. Base:
 - a. Products as indicated.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS – PCL MORTARS

- A. Factory Pre-blended Mortar Mix:
 - 1. Use approved mix designs which comply with ASTM-C270, Property Method.
 - 2. Blend cementitious materials, aggregate and admixtures in factory under controlled conditions, which requires only addition of water at project site.
 - 3. Oven-dry aggregates prior to measuring and include in pre-blended mix.
- B. Use of Mortar in Fire Rated Walls: Wherever a fire resistance rating is indicated for masonry wall provide mortar of type that has been tested and listed for construction indicated.
- C. Portland Cement: ASTM-C150, Type I, II or III.
 - 1. Air-entraining cement is not permitted.
 - 2. Portland Cement Color: As indicated below for each application.
 - 3. Maximum percent of alkalis: 0.60.
- D. Hydrated lime: ASTM-C207, Type S.
- E. Mortar aggregate:
 - 1. ASTM-C144.
 - 2. Aggregate Color: As indicated below for each application.
- F. Water: Clean and potable.
- G. Do not use the following ingredients:
 - 1. Do not use antifreeze additives.
 - 2. Do not use calcium chloride, thiocyanates, or other materials containing chloride ions.
 - 3. Other admixtures: Not permitted without prior approval by Architect.
 - 4. Do not use ready mix mortar.
 - 5. Do not use masonry cement.

2.3 SCHEDULE OF MORTAR TYPES

- A. All PCL mortar mixes to comply with ASTM-C270, property specification using component materials listed above:
 - 1. Limit air content to 10 percent, maximum.
 - 2. Use appropriate type as indicated by following Table 4110A, for each condition.
 - 3. Not all conditions may apply to this Project.

TABLE 4110A - Basic Mortar Type Selection		
Location(s)	Building Segment	Mortar Type per ASTM-C270
EXTERIOR MASONRY, at or below grade	Foundation walls Retaining walls Sewers & manhole, and paving	M
EXTERIOR MASONRY, above grade	Reinforced or Load Bearing brick / block walls Glass Unit Masonry Veneer Masonry, Parapets, and Chimneys >30 FT above grade Other areas with severe exposure	S
	Non-load bearing brick/block walls Veneer Masonry, where <30 FT above grade	N (or S)

TABLE 4110A - Basic Mortar Type Selection		
Location(s)	Building Segment	Mortar Type per ASTM-C270
	Parapets and chimneys where <30 FT above grade	N
INTERIOR MASONRY	Load bearing brick/block walls Non-load bearing brick/block walls Glass Unit Masonry Brick/block veneers	N

2.4 SCHEDULE OF MORTAR COLORS

- A. Use the following mortar colors in conjunction with Table 4110A to determine mixes of appropriate combinations of type and color for each project condition.
- B. Mortar Color MC-1:
 1. Location used:
 - a. Typical at face brick repairs, re-builds, and infill of existing Building 223, See Section 04 21 13.
 2. Method:
 - a. Factory pre-blended mortar.
 3. Mortar Color:
 - a. Natural Grey (no pigment).
 4. Portland Cement Color:
 - a. Natural.
 5. Aggregate Color:
 - a. Natural.
- C. Mortar Color MC-2:
 1. Location used:
 - a. CMU walls. See Section 04 22 00.
 2. Method:
 - a. Factory pre-blended mortar.
 3. Mortar Color:
 - a. Natural Grey, no pigment.
 4. Portland Cement Color:
 - a. Natural.
 5. Aggregate Color:
 - a. Natural.

2.5 MATERIALS – PCL GROUT

- A. Site-mixed PCL Grout:
 1. Use approved mix designs.
 2. Mix on-site using approved materials as indicated.
 3. Factory pre-blended dry grout mixes may be used at contractor's option.
 4. Ready-mixed product, delivered to site for direct placement in walls, may be used at contractor's option.
- B. PCL Grout Mixes – General:
 1. Comply with ASTM-C476.
 2. Portland Cement: ASTM-C150, Type I, II or III.
 - a. Air-entraining cement is not permitted.
 - b. Maximum percent of alkalis: 0.60.
 - c. The use of blended hydraulic cements, including: Portland blast-furnace slag cement, Portland-pozzolan cement, slag cement, and natural cement is not permitted.
 3. Grout aggregate: ASTM-C404.
 - a. Maximum Aggregate Size: 3/8 IN.

- b. The use of blast furnace slag is not permitted.
- 4. Hydrated lime:
 - a. ASTM-C207, Type S.
- 5. Water: Clean and potable.
- 6. Other admixtures: Not permitted without prior approval by Architect.
- 7. Compressive Strength: As indicated by GROUT MIX SCHEDULE, below, for each type.
- 8. Slump for Grout Measured in accordance with ASTM-C143:
 - a. Minimum: 8 IN.
 - b. Maximum: 10 IN.

2.6 PCL GROUT MIX SCHEDULE

- A. Grout Mix GM-1:
 - 1. Site mixed grout.
 - a. Redi-mixed or factory pre-blended may be used at contractor's option.
 - 2. Compressive Strength, 28-day:
 - a. Minimum 2000 PSI.
 - 3. Location used:
 - a. Fill for CMU walls.
 - b. Elevator frames and sills.
 - c. Other indicated locations.
 - 4. Grout color: Natural grey, no pigment.
 - 5. Portland cement color: Natural.
 - 6. Aggregate color: Natural.
 - 7. Grout mixtures shall not contain gypsum.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

3.2 MORTAR INSTALLATION

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Adjust consistency to satisfaction of mason subject to compliance with specified criteria.
- C. Comply with BIA Standard MI-72.
- D. Install in accordance with BIA Standards.
- E. Strike all joints to create a uniformly concave final joint.
- F. If mortar begins to stiffen, it may be re-tempered in accordance with ASTM-C270, Subparagraph 7.4.
- G. Use mortar within 2-1/2 hours of initial mixing.
- H. Remove units which are disturbed after laying. Clean off original mortar and reset with fresh mortar.

3.3 GROUT INSTALLATION

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Use grout within 1-1/2 hours after initial mixing.
- C. Use coarse grout in spaces larger than 2 IN in both directions.
- D. Use fine grout in spaces with least dimension is less than 2 IN.

- E. Grout Installation – frames:
 - 1. Use fine grout for hollow metal door frames.
 - a. Grout frames of elevator hoistway openings.
- F. Grout installation - walls
 - a. See Section 04 22 00.

END OF SECTION

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SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Masonry Accessories, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Welding Standard: Perform welding in accordance with applicable provisions of AWS Structural Welding Code D1.1.
- B. ASTM standards indicated.
- C. Building Code:
 - 1. 2009 edition of the International Building Code enforced by the authority(s) having jurisdiction.
- D. Expansion Joints (versus Control Joints, Construction Joints etc):
 - 1. Movement joints used in brickwork are defined as "Expansion Joints" per BIA "Technical Notes 18A".
 - a. Construct such Expansion Joints per BIA Technical Note 18A.
 - 2. Movement joints used in CMU work are defined as "Control Joints" by NCMA Tek #10-2B.
 - a. Construct such Control Joints per Tek #10-2B and other NCMA standards.
- E. Store materials under cover in a dry place and in a manner to prevent damage.
- F. Immediately before placing, clean reinforcement of substances detrimental to good bond.

1.3 SUBMITTALS

- A. Project information:
 - 1. Manufacturer literature for products proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Masonry Anchors (adjustable wall ties):
 - a. Base:
 - 1) Hohmann & Barnard (H&B).
 - b. Optional:
 - 1) Wirebond.
 - 2) Sandell.
 - 2. Through-wall Flashing - Flexible Membrane with Metal Plate System:
 - a. Base:
 - 1) Hohmann & Barnard (H&B).
 - b. Optional:
 - 1) Sandell Manufacturing Company, Inc.
 - 2) Grace Construction Products.

3. Through-wall Flashing - Flexible Membrane with Metal Plate System (Drip plate, stainless steel):
 - a. Base:
 - 1) Hohmann & Barnard (H&B).
 - b. Optional:
 - 1) Sandell Manufacturing Company, Inc.
4. Termination Bars:
 - a. Base:
 - 1) Tru-Fast Corporation.
 - b. Optional:
 - 1) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard.
 - 3) Sandell Manufacturing Company, Inc.
5. Head Vent, (pre-manufactured):
 - a. Base:
 - 1) Hohmann & Barnard (H&B).
 - b. Optional:
 - 1) Sandell Manufacturing Company, Inc.
6. Rope Wicks (used in conjunction with Head Vent above):
 - a. Base: Products listed.
7. Horizontal Reinforcing:
 - a. Base:
 - 1) Hohmann & Barnard (H&B).
 - b. Optional:
 - 1) Dur-O-Wall.
 - 2) Sandell Manufacturing Company, Inc.
 - 3) Wire-Bond, Masonry Reinforcing Corp of America.
 - 4) Heckman.
8. Pre-molded Control Joint Strips (at CJ's in CMU walls):
 - a. Base:
 - 1) Hohmann & Barnard (H&B).
 - b. Optional:
 - 1) Everlastic.
 - 2) Sandell Manufacturing Company, Inc.
 - 3) Wire-Bond, Masonry Reinforcing Corp of America.
 - 4) Heckman.
9. Galvanizing Repair Paint:
 - a. Base:
 - 1) ZRC Worldwide.
 - b. Optional:
 - 1) Tnemec.
10. Compressible Filler:
 - a. Base:
 - 1) Hohmann & Barnard (H&B).
 - b. Optional:
 - 1) Sandell Manufacturing Company, Inc.
11. Loose Lintels:
 - a. Specified in Section 05 50 10.
12. Structural Steel Lintels and Shelf Angles:
 - a. Specified in Section 05 12 10.
13. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MASONRY WALL ANCHORS

- A. Utilize the following type of anchor devices where terminal ends of masonry walls (i.e. CMU) abut Concrete Beams:

1. Wire tie:
 - a. Base Product: “345 BT” by H&B.
 - b. Material: Same as listed for strap.
 - c. Width: As required for width of CMU.
 - d. Diameter: 3/16 IN.
- B. Rigid Steel Anchors (where CMU walls intersect other CMU walls):
 1. Minimum 1/8 IN x 1 IN x 12 IN.
 2. Galvanized G90.
 3. Ends bent down 2 IN.

2.3 HORIZONTAL REINFORCING

- A. General:
 1. Cold drawn steel wire, ASTM-A82.
 2. Side Rods Diameter: 3/16 IN.
 3. Cross Rods Diameter: 9 GA.
 4. Materials:
 - a. In interior walls:
 - 1) Mill Galvanized, ASTM-A641, Class 3 (0.80 OZ/SF).
 - b. In walls surrounding wet areas with humidity over 70 percent (pools, showers, kitchens, food processing):
 - 1) Hot-dip Galvanized, ASTM-A153, Class B2 (1.50 OZ/SF).
 - c. In exterior walls:
 - 1) Stainless Steel, ASTM-A580 Type 304.
- B. Horizontal Reinforcing – Free-standing CMU Walls:
 1. Scope: Free standing, single-wythe CMU walls not serving as a back-up wall for masonry veneers.
 2. Description: Horizontal reinforcing composite:
 - a. Width(es) as required
 3. Base Product: “#120 Lox-All Truss Mesh” by H&B.
- C. Horizontal Reinforcing – CMU Back-up Walls:
 1. Scope: CMU walls serving as back-up wall for masonry veneers.
 2. Description: Horizontal reinforcing pattern for CMU back-up, with projecting wire loops to accommodate vertically adjustable veneer wire ties.
 - a. Length of projection as required for cavity width indicated.
 - b. Include compatible wire ties for masonry veneer.
 3. The veneer anchor tie shall consist of Wire Ties which interlock into the ladder/truss reinforcing product(s) specified.
 4. “Eye and Pintle” or similar design which permits vertical movement while restraining lateral movement.
 5. Devices used must allow for vertical adjustability during installation, and long-term differential movement.
 6. Tie Component:
 - a. Material: As specified for ladder/truss reinforcing product.
 - b. Diameter: 3/16 IN.
 7. Base Product: “#170 Truss Adjustable Eye Wire” by Hohmann & Barnard.
- D. Horizontal Reinforcing – Masonry Veneers:
 1. Single, continuous wire.
 2. Diameter: 3/16 IN.

2.4 VERTICAL REINFORCING

- A. Reinforcing Bars:
 1. ASTM-A615, Grade-60.
 2. Size: #4's minimum, or as otherwise indicated.

3. Refer to Section 03 20 00, and Drawings.

2.5 MISCELLANEOUS ANCHORAGES

A. General:

1. Include miscellaneous anchorages as required or indicated, such as those necessary to secure stone/APC copings and sills.
2. Type:
 - a. As indicated.

2.6 THROUGH-WALL FLASHING SYSTEM – FLEXIBLE MEMBRANE WITH METAL DRIP PLATE

1. Description:

- a. Material: Flexible, UV-resistant, chemical-resistant, impact-resistant polymer with DuPont “Elvaloy KEE” resin.
- b. Provide with removable paper backing to expose pressure-sensitive adhesive surface.
2. Thickness: 40 mil.
3. Width as required.
4. Factory precut wherever possible.
5. Base Product: “Flex-Flash” by Hohmann & Bernard.
6. Optional Products: “Hyload S/A Membrane” by Hyload Inc.
7. End dams:
 - a. Provide at ends of runs.
 - b. Base Product: “MFL Metal Flashing” by Hohmann & Bernard.
 - 1) 26 gage type 304 stainless steel.
 - c. Optional Product: “Flex-Flash” by Hohmann & Bernard.
 - d. Optional Product: “Hyload S/A Membrane” by Hyload Inc.

B. Stainless Steel Drip Plate (for use with Flexible Membrane flashing.):

1. Description: Stainless steel sheet flashing, with end drip projecting 1/4 to 3/8 IN past the face of masonry.
2. Material: Type 304 Stainless Steel Flashing.
3. Thickness: 24 GA.
4. Foam Seal, 1/8 IN thick, on bottom side.
5. Self-adhesive top surface (w/release paper).
6. Size and profiles as indicated.
 - a. Provide special profiles where lipped brick are indicated.
7. Base Product: “FTSA and/or FTSA-LB” by Hohmann & Bernard.

C. Termination Bar:

1. Use to secure top edge of Flexible Membrane flashing to back-up wall.
2. Material, Base: Aluminum.
3. Material, Optional: Stainless Steel. Plastic, not allowed.
4. Surface type: 1/8 IN x 1 IN x 96 IN., with 1/4 IN x 3/8 IN slotted holes.
5. Base Product: TB-100 Series by Tru-Fast Corporation.

D. Flashing Adhesive:

1. As recommended by manufacturer for bedding, sealing laps, and sealing to vertical surfaces.

2.7 CAVITY VENTS AND WEEPS

A. Vent / Weeps:

1. Head Vent:

- a. Polypropylene honeycomb vent/weep for installation in head joint in brick masonry to provide ventilation of cavity, weeping cavity moisture, and restricting ingress of insects and debris.
- b. Standard size: 3/8 IN x 2-1/2 IN x 3-3/8 IN.
- c. Color: Gray.
- d. Base Product: “QV – Quadro-Vent” by H&B.

2. Rope Weeps:
 - a. Field cut cotton sash cord, nominal 3/8 IN.
 - b. Use in combination with Head Vent, where indicated
 - 1) See Part 3 for locations.

2.8 MISCELLANEOUS ITEMS

- A. Bond Breaker Strips: Asphalt saturated felt, unperforated; ASTM-D226, Type 1.
- B. Pre-Molded Control Joint Strips at CJ's in CMU walls:
 1. Solid rubber strips with a Shore A durometer hardness of 60 to 80.
 2. Designed to fit standard sash block and maintain lateral stability in masonry wall.
 3. Size and configuration as indicated.
 4. Base Product: "#RS Standard" by H&B.
 - a. Exception: Where Sash Blocks are not used: Use "#RS-8" or "#RS-12" as appropriate for wall thickness.
 5. Use symmetrical design for intermediate control joints, and asymmetrical design (Tee-configuration) where CMU wall abuts or intersects a perpendicular element.
 6. Do not bridge CJ's with Horizontal ladder/truss:
 - a. Install 2 smooth dowels or other approved device across Control Joints which resist shear loads but allow in-plane expansion, contraction and linear shrinkage movements.
- C. Galvanizing Repair Paint:
 1. High zinc dust content paint for re-galvanizing welds and abrasions in galvanized steel.
 2. Base Product: "ZRC Galvilite" by ZRC Worldwide.
 3. Optional: "Organic Zinc Coating 90-93" by Tnemec.
- D. Compressible Filler:
 1. Closed cell neoprene sponge.
 2. Thickness: 1/4 IN.
 3. Base Product: "NS" by H&B.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- A. Keep vertical joint behind weeps free of mortar.
- B. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

3.2 INSTALLATION – MASONRY WALL ANCHORS

- A. Anchoring CMU Walls to building superstructure or to other intersecting CMU walls:
 1. Where masonry walls abut concrete or steel structural elements including shear walls, columns, and spandrel beams, anchor thereto with specialized anchors types indicated.
 2. Where bearing walls meet or intersect, erect walls separately and anchor together with rigid steel anchors spaced not more than 24 IN apart vertically.
 - a. Embed end bends of anchors in cores of masonry units filled with mortar or grout.
 3. Where non-bearing walls meet or intersect other walls, erect walls separately and anchor together with wire mesh ties spaced not more than 16 IN apart vertically.
 - a. Embed ties centered in mortar within joint.
 4. Fill solid with mortar or grout masonry unit cells within vertical planes of anchors, or use solid masonry units above and below anchors.

3.3 INSTALLATION – REINFORCING

- A. Reinforcing at CMU Walls: See Section 04 22 00.
- B. Horizontal Reinforcing at Masonry Veneers: See Section 04 21 13.

3.4 INSTALLATION THROUGH-WALL FLASHING

- A. Through-Wall Flashing:
 - 1. General:
 - a. Install to provide positive drainage of cavity moisture.
 - b. Coordinate with built in items and brick ledges.
 - 2. Drip Plate:
 - a. Adhere to Ledge Angle, with drip flange extending past the face of the masonry.
 - 3. Flashing Membrane:
 - a. Extend the bottom edge of flashing over the top surface of Drip Plate.
 - 1) Terminate rubberized flashing membranes 1/2 IN from exterior face of wall.
 - 2) Bond Flashing to Drip Plate.
 - 3) Lap flashing ends minimum of 6 IN and bond 2 pieces together.
 - b. Extend top edge of flashing membrane up face of wall minimum 8 IN.
 - c. Termination of top edge:
 - 1) Where Metal Stud/Gypsum sheathing is the back-up wall:
 - a) Cut Air Retarder as required and temporarily fold up the wall.
 - b) Bond flashing membrane to directly face of sheathing.
 - c) Mechanically secure its top edge with Termination Bar.
 - d) Return Air Retarder back down so that it overlaps Flashing Membrane (shingle style).
 - e) Minimum overlap: 6 IN.
 - 2) Where Masonry wall is the back-up wall:
 - a) Install upper edge of flashing using a Termination Bar.
 - b) Optional: A Reglet may be used in lieu of the Termination Bar.
 - 3) Where Cast-in-place Concrete items are the back-up:
 - a) Secure upper edge of flashing with Termination Bar.
 - b) Optional: A Reglet may be used in lieu of the Termination Bar.
 - 4) Calk top edge of Termination Bar to back-up.
 - d. Provide End Dams as described below, and as indicated.
 - 4. Seal under Ledge Angle with approved backer and sealant (Sealant specified in Section 07 92 13).
 - 5. Use Compressible Filler below relieving angles.
 - 6. Where items penetrate through-wall flashing systems, such as anchors used to secure stone/APC copings and sills:
 - a. Adequately seal around penetrating item.
- B. End Dams (Flexible Membrane Flashing):
 - 1. Configuration:
 - a. Extend lateral ends of flashing beyond openings.
 - b. Return it up and back into head joints.
 - c. Bond to head face of installed masonry units.
 - d. Install sill (stone, brick or other) after End Dam is in place.
 - e. Minimum Height at sides: 4 IN high.
 - f. Comply with BIA TechNote 21B and 7.
 - 2. Provide End Dams made from flexible membrane flashing at the following locations:
 - a. Jamb edges of Sills for doors, windows, louvers and other similar openings.
 - b. Jamb edges of Lintels for doors, windows, louvers and other similar openings.
 - c. Step-flashing (where flashing steps up to follow grade).
 - d. At terminal ends of masonry veneer walls (i.e. where masonry wall meets curtainwall or other material).
 - e. Other similar locations and where indicated.
- C. Head Vents and Rope Wick combination:
 - 1. Locations:
 - a. Base of brick masonry cavity wall and through-wall flashings:
 - 1) Rope Wicks:

- a) Minimum Length: 16 IN.
- b) Locate in first brick course ABOVE through-wall flashing at base of wall.
- c) Space 16 IN O.C. horizontally.
- d) Set outer end of ropes approximately flush with exposed face of masonry veneer.
- e) Loose-lay inner end of ropes at bottom of cavity, running parallel to back face of masonry veneer.
- f) Leave rope wicks in place after mortar has set.
- 2) Head Vent:
 - a) Locate in second brick course ABOVE through wall flashing at base of wall.
 - b) Install Head Vent at 24 IN O.C. horizontally.
- b. Brick masonry cavity walls at shelf angles and through-wall flashing:
 - 1) Rope Wicks:
 - a) Minimum Length: 16 IN.
 - b) Locate in first brick course ABOVE shelf angle and through-wall flashing.
 - c) Space 16 IN apart horizontally.
 - d) Set outer end of ropes approximately flush with exposed face of masonry veneer.
 - e) Loose-lay inner end of ropes at bottom of cavity, running parallel to back face of masonry veneer.
 - f) Leave rope wicks in place after mortar has set.
 - 2) Head Vent:
 - a) Locations:
 - (1) Locate in second brick course ABOVE shelf angle and through-wall flashing.
 - (2) Locate in second brick course BELOW shelf angle and through-wall flashing:
 - b) Install Head Vent at 24 IN apart horizontally.
 - c) Align head vents installed above and below shelf angle and through-wall flashing with each other.
- c. Brick masonry cavity walls at continuous lintel angles and through-wall flashing:
 - 1) Rope Wicks:
 - a) Minimum Length: 16 IN.
 - b) Locate in first brick course above continuous lintel angle and through-wall flashing.
 - c) Space 16 IN apart horizontally.
 - d) Set outer end of ropes approximately flush with exposed face of masonry veneer.
 - e) Loose-lay inner end of ropes at bottom of cavity, running parallel to back face of masonry veneer.
 - f) Leave rope wicks in place after mortar has set.
 - 2) Head Vent:
 - a) Locate in second brick course above continuous lintel angle and through-wall flashing.
 - b) Install Head Vent at 24 IN apart horizontally.
- d. Brick masonry joints at top of brick cavity wall:
 - 1) Head Vent:
 - a) Locate in second brick course below coping and through-wall flashing, or metal cap flashing.
 - b) Install Head Vent at 24 IN apart horizontally.

3.5 INSTALLATION OF OTHER ITEMS

- A. Galvanizing Repair Paint:
 - 1. Apply wherever galvanized masonry accessories are welded or where the galvanic coating is scratched, abraded or otherwise damaged.

B. Compressible Filler:

1. Install in the masonry joint below relief angles to preclude mortar from being installed in the joint.
2. Install sealant per Section 07 92 13 in joint to insure water-tightness.

END OF SECTION

SECTION 04 21 13

BRICK MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Brick Masonry, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Tolerances:
 - 1. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arises:
 - a. 1/4 IN in 10 FT.
 - b. 3/8 IN in a story height not to exceed 20 FT.
 - c. 1/2 IN in 40 FT or more.
 - 2. Maximum variation from plumb for external corners, expansion joints and other conspicuous lines:
 - a. 1/4 IN in any story or 20 FT maximum.
 - b. 1/2 IN in 40 FT or more.
 - 3. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
 - a. 1/4 IN in any bay or 20 FT.
 - b. 1/2 IN in 40 FT or more.
 - 4. Maximum variation from plan location of related portions of columns, walls and partitions:
 - a. 1/2 IN in any bay or 20 FT.
 - b. 3/4 IN in 40 FT or more.
 - 5. Maximum variation in cross sectional of columns and thicknesses of walls from dimension indicated:
 - a. Minus 1/4 IN.
 - b. Plus 1/2 IN.
- B. Quality standards:
 - 1. Construction to conform to Brick Industry Association (BIA) standards.
- C. Masonry installer qualifications:
 - 1. More than 5 years successful experience in installation of brick masonry systems similar to system required.
 - 2. Have sufficient experienced personnel to produce required work without causing delay in work.
 - 3. Include with bid 5 references from Laboratories, contractors, or architects for similar size projects.

1.3 PRE-INSTALLATION MEETING

- A. A pre-installation meeting, directed by Contractor, will be held prior to the beginning of masonry work to discuss:
 - 1. Structural concept.
 - 2. Method and sequence of masonry construction.
 - 3. Sample panel construction.
 - 4. Special masonry details.
 - 5. Standard of workmanship.
 - 6. Quality control requirements.
 - 7. Maintenance.
 - 8. Job organization.
- B. Attendance is recommended for:
 - 1. Contractor job superintendent.

2. Masonry installer's job superintendent.
3. Masonry installer's foreman.
4. Minimum two masons.
5. Authorized representative of brick supplier.
6. Mortar material suppliers.
7. Other trades whose work penetrates brick work or is attached thereto.

1.4 SUBMITTALS

- A. Samples:
 1. Brick for Architect review and verification of color match to existing face brick.
- B. Project information:
 1. Certification of brick type and grade.
 2. Minutes from Brick Masonry Pre-installation Meeting.
- C. Contract closeout information:
 1. Annual inspection checklist.
 - a. See BIA Technical Note 46.
- D. LEED Requirements:
 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver units on pallets with tight covers or deliver in cubes and store covered on dunnage.
- B. Protect materials from elements.
- C. Inspect masonry upon delivery to ensure color match with sample wall.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Brick:
 1. Endicott Clay Products.
 2. Yankee Hill.
 3. Belden Brick.
 4. Glen-Gery.
 5. Sioux City Brick and Tile.

2.2 MATERIALS

- A. Face Brick (FB-1): To be used for infill, patching, repair, and reconstruction of existing brick masonry walls of adjacent Building 223.
 1. Size:
 - a. Modular.
 2. Type: FBS, Grade-SW, ASTM-C216.
 3. Include special shaped, sized or cut brick as required for complete installation.
 4. Match existing brick of Building 223.
- B. Face Brick (FB-2): To be used for infill, patching, repair and reconstruction of existing brick masonry walls of adjacent Building 222.

1. Size:
 - a. Modular.
 2. Type: FBS, Grade-SW, ASTM-C216.
 3. Include special shaped, sized or cut brick as required for complete installation.
 4. Match existing brick of Building 222.
- C. Mortar: See Section 04 05 13.
- D. Masonry accessories: See Section 04 05 23.
- E. Sealants: See Section 07 92 13.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept work.
- B. Verify anchors and flashings.
- C. Installation constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.
- B. Build walls to thickness indicated.
- C. Build single wythe walls to actual masonry thickness.
- D. Build in flashing, reinforcing, weeps and related items.
- E. Cut units as required to provide patterns indicated.
 1. Make cuts clean, square and free of jagged edges.
 2. Units that will be installed in "normal" orientation (and cut to "length" or "width"):
 - a. Perform cutting with masonry saws.
 - b. Saw-cut faces shall not be exposed to view.
 - c. Saw-cut edges may be exposed.
 3. Units that will be installed in a "rotated" orientation:
 - a. Hand cutting is permitted.
 - b. Hand cut faces and hand cut edges shall not be exposed to view.
- F. Use solid units where holes would be exposed in finish work.
- G. Install in running bond.
- H. Avoid use of less than half size units.
- I. Do not install damaged units.
- J. Wet brick having absorption rates greater than 30 G/30 SQ IN/MIN in compliance with BIA recommendations.
- K. Install brick work in conjunction with concrete unit masonry work.
- L. Protect against weather, when work is not in progress.
- M. Cover top of walls with waterproof membrane, extending 4 FT down both sides of walls, anchored in place.
- N. Protect against cold weather as specified in Section 04 05 05.

3.3 LAYING AND TOOLING

- A. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.
- B. Properly locate openings, movement type joints, returns and offsets.
- C. Lay brick with completely filled bed and head joints.
- D. Butter ends with sufficient mortar to fill head joints and shove into place.
- E. Do not slush head joints.
- F. Maintain nominal 3/8 IN joint widths.
 - 1. Cut joints flush where concealed.
 - 2. Tool concave joints.
 - 3. Compress mortar in below grade joints.
- G. During tooling of joints, enlarge voids or holes, except weep holes, and completely fill with mortar.
- H. Point up joints at corners, openings and adjacent work to provide neat, uniform appearance.
- I. Remove brick units disturbed after laying.
 - 1. Clean and relay in fresh mortar.
 - 2. Do not pound units to fit.
 - 3. If adjustments are required, remove units, clean and reset in fresh mortar.
- J. Where work is stopped and later resumed, rack back 0.5 brick unit length in each course.
 - 1. Wet units lightly.
 - 2. Remove loose units and mortar prior to laying fresh masonry.
 - 3. Do not tooth.
- K. As work progresses, build in items indicated and specified.
 - 1. Fill in solidly with mortar around built in items.
 - 2. Coordinate with metal frame suppliers.
 - 3. Grout fill space between metal frames and masonry.
- L. Provide positive means to keep cavity free of mortar.
 - 1. Water test weep holes.

3.4 REINFORCING

- A. General:
 - 1. Coordinate with backer material to provide required reinforcement.
 - 2. Center single wire reinforcing.
 - 3. Locate reinforcing, and other embedded items such that a minimum cover of mortar is maintained as follows:
 - a. 5/8 IN on exterior side of walls.
 - b. 1/2 IN at other locations.
 - 4. Lap ends minimum of 6 IN.
 - 5. Do not bridge Expansion Joints (a.k.a Control Joints) with reinforcing.
 - 6. Make corners and wall intersections by use of prefabricated "L" and "T" sections.
 - 7. Cut and bend units as required.
 - 8. Install at 16 IN OC vertically.
 - 9. Install at 8 IN OC in starter courses.
- B. Reinforce masonry openings over 12 IN wide, where Expansion Joints are not provided:
 - 1. Utilize horizontal joint reinforcing placed in 2 horizontal joints directly above lintel and in 2 horizontal joints directly below sill.
 - 2. Extend reinforcing minimum of 24 IN beyond jambs of opening.
- C. Brick veneer over CMU backup:
 - 1. Anchor veneer to backup with horizontal joint reinforcing at 16 IN OC vertically.

3.5 MOVEMENT JOINTS, FLASHING AND SEALANTS

- A. General:
 - 1. Form movement joints by leaving head joints between stacked units void of mortar, ready for application of backer and joint sealant.
- B. Horizontal Expansion Joints:
 - 1. Locate as indicated.
 - 2. Where not indicated:
 - a. Locate immediately below shelf angles.
 - b. For brick infill, place between the top of brickwork and structural frame.
 - c. Parapets which do not have a shelf angle (where parapet veneer bears directly on veneer of floor below):
 - 1) Lay brick normally in full bed joint of mortar.
 - 2) Rake out the face of joint to a depth of 3/4 IN while still plastic.
 - 3) Install backer rod and sealant.
- C. Vertical Expansion Joints (a.k.a. control joints and isolation joints):
 - 1. Locate as indicated.
- D. Form movement joints by leaving head joints between stacked units void of mortar, ready for application of backer and joint sealant.
- E. Do not continue horizontal joint reinforcing across movement joints.
- F. Install horizontal Expansion Joints where indicated.
- G. See Section 04 05 23 for flashing and weep installation requirements.
- H. See Section 07 92 13 for sealant installation requirements.
 - 1. Seal joints between brick and relieving lintels.
 - 2. Seal Expansion Joints.
 - 3. Seal spaces at end of relieving lintels.

3.6 REPAIR, POINTING AND CLEANING

- A. Remove and replace loose, stained, or damaged bricks.
 - 1. Provide new units to match.
 - 2. Install in fresh mortar.
 - 3. Point to eliminate evidence of replacement.
- B. Clean in accordance with Section 04 05 10.

END OF SECTION

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Issued for Construction - 6/30/11

SECTION 04 22 00
CONCRETE MASONRY (CMU)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Concrete Masonry (CMU), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Quality assurance:
 - 1. Test results performed to qualify materials and establish mix designs
- B. Project Information:
 - 1. Units to be used in Fire Rated walls: Certification of level of fire-resistance provided by units proposed (determine by either Equivalent Thickness method referenced).
- C. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and MR 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver units on pallets with tight covers or deliver in cubes and store covered on dunnage.
- B. Protect materials from elements.

1.4 JOB CONDITIONS

- A. Protect against weather, when work is not in progress.
- B. Cover top of walls with waterproof membrane, extend at least 4 FT down both sides of walls; anchor in place.
- C. Provide cold weather protection; Section 04 05 05.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Units to be used in Fire-Resistive wall assemblies:
 - 1. Where units are used in assemblies with Fire-Resistive Rating:
 - a. Provide units with aggregate type, and equivalent thickness that yield fire-resistances indicated for each wall assemblies.
 - b. Acceptable calculation methodologies for determining Equivalent Thickness:
 - 1) NCMA TEK 7-1A.
 - 2) ACI 216.1 / TMS 0216.
 - c. Units tested per ASTM-E119 are also acceptable.

2. Provide solid units, or grouted hollow units, under lintels.
3. Provide matching concrete bricks as required.
4. Do not use chipped, cracked, spalled units exposed in finish work.
5. Provide reinforced concrete masonry lintels fabricated from precast or site cast load bearing masonry units, filled and reinforced as indicated.

2.2 CONCRETE MASONRY UNITS - GENERAL-PURPOSE

- A. Concrete Masonry Units (CMU):
 1. Modular units complying with ASTM-C90.
 2. Aggregate:
 - a. Medium Weight: In accordance with ASTM-C331.
 3. Sizes and shapes as indicated or required for conditions.
 4. Face shell and web thickness: Table 3, ASTM-C90.
- B. Corner Units:
 1. Exposed to view: Use bullnosed units at external corners and jambs of openings.
 2. Not Exposed to view: Square-nosed units may be used where corners will not be visible in completed wall.

2.3 CONCRETE LINTELS AND SILLS

- A. General:
 1. Fabricate concrete lintels and sills in plant or site cast.
 2. Use concrete having minimum 28 day compressive strength of 3000 PSI.
 3. Exposed surfaces to have surface texture and color to match adjacent concrete masonry units.
 4. Fabricate lintels to modular sizes to match coursing.
 5. Mark tops of lintels with lintel schedule number.
- B. Fabricate lintels by one of following methods:
 1. Use masonry lintel units and reinforced concrete fill.
 2. Cast lintels monolithically with reinforcement.
 3. Provide vertical dummy joints matching pattern of vertical joints and scoring in concrete masonry walls in which installed.

2.4 REINFORCING

- A. Horizontal Reinforcing products including wire ladder truss: Specified in Section 04 05 23.
- B. Reinforcing Bars (vertical and horizontal): Specified in Section 03 20 00.

2.5 ACCESSORY ITEMS

- A. Masonry accessories: See Section 04 05 23.
- B. Mortar and grout: See Section 04 05 13.
- C. Sealants: As specified in Section 07 92 13 and Section 07 92 16.
- D. Grout fill: As specified in Section 04 05 13.
- E. Masonry Veneer Anchors: Specified in Section 04 05 23.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept work.
- B. Verify that anchors and flashings are correct.

C. Installation constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION - GENERAL

A. General:

1. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.
2. Build walls to thickness indicated.
3. Build single wythe walls to actual masonry thickness.
4. Perform cutting with masonry saws.
5. Cut as required to provide pattern indicated.
6. Use solid units where cutting or laying would expose holes.
7. Do not install damaged units.
8. Do not wet concrete masonry units.
9. Avoid use of less than half size units.
10. Build chases and recesses as indicated and required for work of other trades.

B. Install in running bond unless otherwise indicated.

C. Identification of Fire and Smoke Walls:

1. Identify partitions indicated on Drawings as having a required fire or smoke rating.
2. Identification: Same as indicated on drawing legend.
3. Location: 10 FT on center, both sides of partition, above ceiling line.
 - a. Above access panels in hard ceiling.
4. Lettering: 2 IN Helvetica, painted with aid of stencils.
5. Color: Red.

D. Elevator Door Frames:

1. Block-out as required by Elevator Manufacturer to allow for door frames to be set.
2. After door frames have been set, fill in with like construction and grout cores solid.

3.3 LAYING AND TOOLING

A. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.

B. Properly locate openings, movement type joints and offsets.

C. Lay masonry units with face shells of bed joints fully mortared.

1. Webs shall be fully mortared in all courses of piers, columns, and pilasters, and in the starting course on foundations, and when necessary to confine grout or loose filled insulation.
2. Head joints shall be mortared a minimum distance from each face equal to the face shell thickness.
3. Vertical cells to be grouted shall be aligned and unobstructed openings.

D. Maintain nominal 3/8 IN joint widths.

1. Cut joints flush where concealed.
2. Tool exposed joints.
3. Compress mortar in below ground joints.

E. During tooling of joints, enlarge voids or holes, except weepholes, and completely fill with mortar.

F. Point up joints at corners, openings and adjacent work to provide neat, uniform appearance.

G. Remove masonry disturbed after laying.

1. Clean and relay in fresh mortar.
2. Do not pound units to fit.
3. If adjustments are required, remove units, clean, and reset in fresh mortar.

H. Where work is stopped and later resumed, rake back 0.5 masonry unit length in each course; do not tooth.

1. Remove loose units and mortar prior to laying fresh masonry.

- I. As work progresses, build in items indicated and specified.
 - 1. Fill in solidly with mortar around built-in items.
 - 2. Grout fill space between metal frames and masonry.
 - 3. Where built-in items are to be embedded in cores of hollow masonry units, place layer of metal lath in joint below and fill core with grout.
- J. Remove masonry protrusions extending 1/2 IN or more into cells or cavities to be grouted.

3.4 REINFORCING

- A. General:
 - 1. In addition to the following general requirements, provide reinforcing size type and spacing as indicated on Drawings and Details.
- B. General Reinforcing Requirements:
 - 1. Reinforce masonry openings over 12 IN wide, where control and expansion joints are not provided, with horizontal joint reinforcing placed in 2 horizontal joints above lintel and below sill.
 - a. Extend reinforcing minimum of 24 IN beyond jambs of opening.
 - 2. Embed horizontal reinforcing in bed joint mortar for entire length with minimum cover of 5/8 IN on exterior side of walls and 1/2 IN at other locations.
 - a. Provide same minimum cover for other embedded items.
 - 3. Minimum laps for horizontal reinforcing: 6 IN.
 - 4. Do not bridge Control Joints or Expansion Joints with horizontal reinforcing.
 - a. Install smooth dowels or other approved device across Control Joints which resist shear loads but allow in-plane expansion, contraction and linear shrinkage movements.
 - 5. Provide continuous horizontal joint reinforcing in walls all concrete masonry walls.
 - a. See elsewhere for reinforcing requirements for anchored veneers.
 - 6. Unless otherwise indicated:
 - a. Install horizontal reinforcing with in 8 IN of first bed joint.
 - b. Running Bonds: Install horizontal reinforcing at 16 IN OC vertically thereafter.
 - c. Stacked Bonds: Install reinforcing 8 IN OC vertically thereafter where stack bond masonry is indicated.
 - 7. Make corners and wall intersections by use of prefabricated "L" and "T" sections.
 - a. Cut and bend as required.
 - 8. At intersecting load bearing walls install rigid steel anchors not over 24 IN OC vertically.
 - a. Embed ends in grout filled cores.
- C. Horizontal Reinforcing Bars:
 - 1. Install where indicated.
 - 2. Sizes as indicated.
- D. Vertical Reinforcing Bars at CMU Walls other than Anchored Veneers:
 - 1. Install vertical reinforcing bars as indicated.
 - 2. When not indicated, provide the following minimum vertical reinforcing:
 - a. Provide one No.5 continuous at 48 IN on center.
 - b. Provide one No.5 Continuous at each corner, at each side of each opening, at each side of each control joint, and at the ends of walls.

3.5 GROUT FILL

- A. Do not place grout until entire portion of wall to be grouted has attained sufficient strength to resist grout pressure.
- B. Use mechanical means to remove air pockets and void for proper consolidation of fill.
- C. Grout walls incrementally as CMU is placed. Minimize lift heights to ensure that walls will remain safe and stable until grout has attained sufficient strength to resist overturning or collapse.

1. Consider detrimental lateral loads which could be anticipated including storms, winds, seismic, soil etc.
 2. Adequately brace as needed.
- D. Where vertical or horizontal reinforcing bars are required, place and inspect prior to filling operation.
- E. Fill cores containing vertical reinforcing.
- F. Place in maximum 4 FT lifts.
- G. Leave lifts minimum 1-1/2 IN below top of course to form key with next lift.

3.6 CONTROL JOINTS (CJ)

- A. Provide Control Joints (and other movement joints) as indicated.
- B. Where not indicated:
1. Locate CJ's at natural planes of weakness in masonry wall such as:
 - a. Changes in wall height.
 - b. Changes in wall thickness, such as at pipe and duct chases and pilasters.
 - c. At (above) movement joints in foundations and floors on which wall is bearing.
 - d. At (above) movement joints in roofs and floors that bear on wall.
 - e. Openings: Within 8 IN of one or both jambs of door, window, louver and similar openings:
 - 1) Place CJ at one side of openings less than 6 FT wide.
 - 2) Place CJ at both sides of openings greater than 6 FT wide.
 - f. Corners: Within 4 FT of corners (on at least one leg).
 - 1) Opposing leg: No more than 20 FT from corner.
 - g. Intersections: Within 12 FT of wall intersections.
 2. In addition to of the above, locate CJ's at no more than the following absolute maximum (horizontal) distances:
 - a. Walls less than 16 FT-8 IN tall: Not more than 1-1/2 times the wall height.
 - b. Walls greater than 16 FT-8 IN tall: No more than 25 FT O.C.
- C. Installation/construction of CJ's:
1. Utilize sash blocks or similar shapes which have slotted end to accept gaskets.
 - a. Pre-molded Control Joint Strips: Specified in Section 04 05 23.
 2. Cut ladder/truss type horizontal reinforcing as it crosses CJ's.
 3. While mortar is still fresh, rake out mortar from joint, leaving a completely clean joint.
 4. After wall has cured, install backer rod and sealant on both wall faces.
 - a. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.

3.7 LINTELS, FLASHING AND SEALANTS

- A. Installation of flashing, weeps and similar masonry accessories: Specified in Section 04 05 23.
- B. Sealant installation requirements:
1. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.
 2. Remove mortar in joint under relieving lintel and at ends.
 3. Seal joints between CMU's and relieving lintels.
 4. Seal Expansion and Control Joints.
- C. Provide precast masonry lintels wherever openings more than 12 IN wide are indicated without other structural support or other supporting lintels.
1. Thoroughly cure lintels before handling and installation.
 2. See lintel schedule for size and type required.

3.8 INSTALLATION TOLERANCES

- A. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arises:
1. 1/4 IN in 10 FT.

2. 3/8 IN in a story height not over 20 FT.
 3. 1/2 IN in 40 FT or more.
- B. Maximum variation from plumb for external corners, control joints, expansion joints and other conspicuous lines:
1. 1/4 IN in any story or 20 FT maximum.
 2. 1/2 IN in 40 FT or more.
- C. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
1. 1/4 IN in any bay or 20 FT.
 2. 1/2 IN in 40 FT or more.
- D. Maximum variation from plan location of related portions of columns, walls and partitions:
1. 1/2 IN in any bay or 20 FT.
 2. 3/4 IN in 40 FT or more.
- E. Maximum variation in cross section of columns and thicknesses of walls from dimensions indicated:
1. Minus 1/4 IN.
 2. Plus 1/2 IN.

3.9 REPAIR, POINTING AND CLEANING

- A. Remove and replace loose, stained, or damaged units.
1. Provide new units to match.
 2. Install in fresh mortar.
 3. Point to eliminate evidence of replacement.
- B. Clean in accordance with Section 04 05 10.

3.10 INSPECTION AND TESTING

- A. Permit and facilitate access to the construction sites and the performance of activities for quality assurance by the testing and inspection agencies.
- B. Comply with the requirements of ACI 530.1 Section 1.6C and facilitate the testing and inspection agencies needs.
- C. The Laboratory will provide testing and inspection services. This does not relieve the contractor of the responsibility to furnish materials and construction in full compliance of contract documents.

END OF SECTION

SECTION 05 12 10
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Structural Steel, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Structural steel work covered herein shall be fabrication and erection of steel framing and bracing members including connections and steel material either supporting or connected to steel members shown on structural plans and not specified in other sections.
- B. Quality standards latest edition of the following standards plus any corresponding published revisions at the time of bidding shall be the applicable standard. The Local Building Code shall govern when conflicts occur.
 - 1. Local Building Code as indicated on the drawings, including local amendments.
 - 2. American Institute of Steel Construction (AISC):
 - a. "Load and Resistance Factor Design Specification for Structural Steel Building" (referred to herein as the AISC Specification).
 - b. Code of Standard Practice for Steel Buildings and Bridges (referred to as AISC Code of Standard Practice), excluding the following sections, and/or paragraphs – 1.5, 1.7.2, 1.7.3, Section 3, 4.1, 4.4, 4.5, 4.6, 7.1, 7.2, the last sentence of paragraphs 8.1.1, and 8.1.2, Section 9, and Appendix A.
 - c. Quality Certification Program.
 - 3. American Welding Society:
 - a. Structural Welding Code - Steel ANSI/AWS-D1.1 (referred to herein as the AWS Code). The AWS Code shall govern the techniques and quality of welding and testing procedures. Statements contained in the AWS Code requiring information to Bidders and/or Contract Documents to define nondestructive testing or statements defining responsibilities and obligations for services and payment shall be disregarded.
 - 4. Research Council on Structural Connections: Load and Resistance Factor Design Specifications for Structural Joints Using ASTM-A325 or A490 Bolts (referred to herein as the RCSC Specification).
 - 5. Steel Structures Painting Council (SSPC): Steel Structures Painting Manual Vol. 2, "System and Specifications" (referred to herein as the SSPC Specification).
- C. Qualifications:
 - 1. Steel fabricator:
 - a. Certified by AISC Quality Certification Program for Structural Steel Fabricators and is designated as AISC Certified Fabricator, Standard for Steel Building Structures.
 - 2. Steel erector:
 - a. Minimum 10 years experience in erection of structural steel.
 - b. Certified as Certified Steel Erector by AISC quality Certification Program.
- D. Source quality control:
 - 1. Provide access and facilities for testing agency during shop and field inspections.

- E. Testing and inspection: Testing, (except testing to qualify welders and as needed for Contractor's own quality control), will be performed at no cost to Contractor by a Testing/Inspection Agency employed by Laboratory. Laboratory's Testing/Inspection Agency may use nondestructive testing methods in addition to visual inspection to verify weld quality. Repair rejected welds as directed by Testing/ Inspection Agency at no additional cost to Laboratory.
- F. Provide testing and inspection agency with sufficient notification and access so that inspection and testing can be accomplished.
- G. Previous acceptance of material or finished members by testing and inspection agency or Architect/Engineer shall not prevent its rejection at later date if it does not comply with specifications.
- H. Tolerances:
 - 1. Rolling: ASTM-A6.
 - 2. Fabrication and Erection tolerances: AISC Code of Standard Practice.
- I. Complete final design of connections not defined on Contract Documents.
 - 1. Design connections at each end of member for loads (in Kips) noted in parenthesis. If load not indicated, design for capacity of member.
 - 2. Connection arrangement and detail shall be consistent with similar connections where indicated on Contract Documents.
 - 3. Connection design shall satisfy applicable Building Codes and shall use latest approach to design as offered by AISC.
 - 4. Connection design shall be prepared by an Illinois Licensed Structural Engineer.

1.3 SUBMITTALS

- A. Product data:
 - 1. Source and certification of quality for high-strength bolts, nuts and washers.
 - 2. Technical data on base plate grout.
- B. Shop drawings:
 - 1. Indicate details including cuts, copes, connections, holes and welds. Indicate shop and field welds using AWS symbols. Indicate connections where high strength bolts are required. Shop drawings submitted without the required connection documentation will be returned without review.
 - 2. Headed stud placement drawings.
- C. Project information:
 - 1. Fabricator's AISC Certification.
 - 2. Steel erector's AISC Certification along with proof that steel erector has 10 years experience in erection of structural steel.
 - 3. Connection design calculations, signed and sealed by the Illinois Licensed Structural Engineer responsible for their preparation. Connection calculations must be coordinated with and submitted with the shop drawings.
 - 4. Welding Procedure Specification (WPS) for shop and field welds.
- D. Contract closeout information:
 - 1. Certificate shall be submitted within 10 working days of completion of the structural steel framing.
 - 2. Certification by fabricator that steel was fabricated in accordance with the approved shop drawings and specifications.
 - 3. Certification by erector that steel was erected in accordance with the approved erection plans and specifications.
 - a. Certification shall be based on surveyed documentation of conformance with tolerances performed by an Illinois Licensed Surveyor.
- E. LEED Information:

1. MR 4.1 and 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content for LEED calculations.
2. MR 5.1 and 5.2: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material for LEED calculations. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel, structural “W” shapes and tee’s: ASTM-A992 (50 ksi yield point).
- B. Other steel shapes and plate: ASTM-A36.
- C. Pipe round: ASTM-A500, Grade-B(42 KSI minimum).
- D. Tubing square or rectangular: ASTM-A500, Grade-B(46 KSI minimum).
- E. Bolts, nuts, and washers, high-strength. Conform to RCSC Specification
 1. Twist off style, conform to ASTM F1852
 - a. Approved bolts:
 - 1) Tension control bolt by LeJeune Bolt Company, Burnsville, MN.
 - 2) Tru-Tension Fasteners by Nucor Fastener a Division of Nucor Corporation, St. Joe, Indiana.
 - 3) St. Louis Screw and Bolt, Madison, IL.
- F. Bolts, nuts and washers, standard strength:
 1. Bolts: ASTM-A307, Type A.
 2. Nuts: ASTM-A563.
 3. Washers plain: ANSI/ASME-B18.22.1.
- G. Anchor rods, standard strength:
 1. Rod for threading: ASTM-A36 or ASTM-F1554-36 ksi.
 2. Nuts and washers:
 - a. Nuts: ASTM-A563.
 - b. Washers plain: ANSI/ASME-B18.22.1.
 3. Thread tolerance: ANSI/ASME-B18.1, Class 2A.
- H. Welding electrodes:
 1. Shielded metal-arc: AWS A5.1 or AWS A5.5, E70XX
 2. Submerged-arc: AWS A5.17 or A5.23, F7X-EXXX.
 3. Gas metal-arc: AWS A5.18, E70S-X or E70U-1.
 4. Flux cored-arc: AWS A5.20, E70T-X (except 2, 3, 10, GS).
- I. Headed studs and deformed bar anchors:
 1. Headed studs (HS)
 - a. Fabricated from cold drawn bar stock conforming to ASTM A 108, grades 1010 through 1020.
 - b. AWS D1.1 type B.
 - c. Minimum Yield strength: 51 ksi.
 - d. Minimum tensile strength: 65 ksi over 3/8 IN diameter.
 - e. Minimum tensile strength: 55 ksi 3/8 IN diameter and under.
 2. Deformed anchor bars (DBA): Straight, unless otherwise indicated.
 - a. ASTM A496.
 - b. Minimum yield strength: 70 ksi.
 - c. Minimum tensile strength: 80 ksi.

- J. Grout: Pourable.
 - 1. "Duragrout" as manufactured by L&M Construction Chemicals, or equal.
 - 2. Minimum Strength : 4000 psi at 7 days and 8000 psi at 28 days.
- K. Expansion anchors:
 - 1. Expansion anchors shall be a single-end expansion shield anchor which complies with the descriptive part of Federal Specification FF-S325, Group II, Type 4, Class 1 for concrete expansion anchors. Anchors shall be Hilti Kwik Bolt TZ Expansion anchor by Hilti fastening systems of Tulsa, OK (ICC Report No. ESR-1917) or equal.
- L. Adhesive anchors:
 - 1. Reinforcing, bar dowels, reinforcing bars, threaded rods, bolts, etc., indicated to be epoxy dowelled into concrete or solid masonry:
 - a. HIT HY-150 MAX adhesive by Hilti Fastening Systems of Tulsa, OK (ICC Report No. ESR-1967, ASTM-E1512) or equal.
 - b. Unless indicated otherwise, adhesive anchor bolt shall conform to HAS – E Standard ISO Class 5.8 by Hilti or equal. Do not field cut rods without engineer's approval.

2.2 FABRICATION

- A. General:
 - 1. Fabricate and assemble material in shop to greatest extent possible.
 - 2. Use A325 bolts, twist-off type, unless otherwise indicated.
 - 3. One sided or other types of eccentric connections not indicated, will not be permitted without prior approval.
 - 4. Bevels for field welds may be flame cut provided such cutting is done automatically. Leave free of burrs and slag.
 - 5. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
 - 6. Flame cut edges of stiffener plates at field or shop butt welds. Do not shear.
 - 7. Accurately mill bearing ends of columns.
 - 8. Trusses, beams and girders over 50 FT in length shall be cambered in an amount required by the Architect. Members less than 50 FT in length shall be cambered when indicated on the drawings or otherwise fabricate such that after erection any natural camber due to rolling or assembly is upward.
 - 9. Cut, drill, or punch holes at right angles to surface of metal.
 - a. Do not make or enlarge holes by burning.
 - b. Make holes clean cut, without torn or ragged edges.
 - c. Remove outside burrs resulting from drilling or reaming operations with tool making 1/16 IN bevel.
 - d. Provide holes in members to permit connection of work of other trades.
 - 10. Make allowance for draw in of tension bracing.
 - 11. Make splices only as indicated.
 - 12. Headed stud type shear connectors (H.S.) and deformed bar anchors (D.B.A.), on Drawings: Automatically end welded in accordance with AWS Code.
 - a. When headed stud type shear connectors are to be either shop or field applied, clean top surface of beam flanges in shop to remove oil, scale, rust, dirt and other materials injurious to satisfactory welding.
 - b. Fillet welding of headed studs and deformed anchors is not allowed without prior approval.
 - c. Do not weld studs when temperature is below 0 degF or surface is wet with rain or snow.
 - d. After welding, remove ceramic ferrules and maintain clean and free from substances which would interfere with function as anchor or bond of deformed anchor bars.
 - e. Quality control: Weld minimum of 2 studs at start of each production period to determine proper generator, control unit, and stud welder settings.
 - 1) These studs shall be capable of being bent 45 degrees from vertical without weld failure. These studs shall not be included as a part of the required construction.
 - 2) All production studs shall be sounded by a sharp blow with a hammer.

- 3) If, after welding, a stud does not ring when struck by a hammer or visual inspection reveals that sound weld or full 360 degree fillet has not been obtained for a particular stud, that stud shall be struck with hammer and bent approximately 15 degrees off perpendicular to nearest end of beam.
- 4) Studs meeting this test shall be considered acceptable and shall be left in this position.
- 5) Studs bent beyond 15 degrees shall be considered ineffective and replaced.
- 6) Studs failing under this test shall be replaced.

B. Welding:

1. Welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work shall comply with AWS Code, and requirements indicated.
2. Test and qualify welding operators and tackers in compliance with AWS Code for position and type of welding to which they will be assigned.
 - a. Conduct tests in presence of approved testing agency.
 - b. Certification within last 12 months from a welding inspector will be acceptable provided samples of welder's work are satisfactory.
 - c. At discretion of testing agency, shop personnel continuously employed at welding process for which they have been qualified may be accepted from older qualification tests.
3. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
4. Before start of welding work, meet with testing agency and welders to review and verify procedures.
5. Comply with AWS Code to minimize shrinkage and distortion stress.
6. Use back-up plates in accordance with AWS Code, extending minimum of 1 IN either side of joint.
7. Make flange welds before making web welds.
8. For manual shielded metal-arc welding: Comply with Article 4.6 of AWS Code.
9. Low hydrogen electrodes: Dry and store electrodes in compliance with AWS Code.
10. Do not perform welding when ambient temperature is lower than 0 degF, or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
11. Before starting welding:
 - a. Carefully plumb and align members.
 - b. Fully tighten bolts.
 - c. Assembly and surface preparation shall comply with AWS Code.
 - d. Preheat base metal to temperature stated in AWS Code.
 - 1) When no preheat temperature is given and base metal is below 32 degF, preheat base metal to at least 70 degF.
 - 2) Maintain temperature during welding.
 - 3) Preheating shall bring surface of base metal within distance from point of welding equal to thickness of thicker part being welded or 3 IN, whichever is greater, to specified preheat temperature.
 - 4) Maintain this temperature during welding.
 - e. Each welder is to provide identifying mark at welds worked on.

2.3 SURFACE PREPARATION AND SHOP-APPLIED COATINGS

A. Surfaces not to be coated:

1. Do not coat following surfaces:
 - a. Surfaces to be fireproofed with spray-on material.
 - b. Machined surfaces, surfaces adjacent to field welds, contact surfaces of bolt connections where connection is specified as slip critical, and top of top flanges of beams.
2. Clean thoroughly before shipping; remove loose mill scale, rust, dirt, oil and grease.

B. Hot-dip Galvanized (HDG) members:

1. Galvanize following members:

- a. Members set in, or in contact with, exterior surface material, including:
 - 1) Brick ledge angles.
 - 2) Embedded items in exterior surfaces.
- b. Exterior exposed structure not indicated to be shop otherwise shop finished.
- c. Other members indicated.
- 2. Clean thoroughly before galvanizing.
- 3. Galvanize in accordance with ASTM-A123.
- C. Interior Surfaces to be shop-primed for finish paint:
 - 1. Primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series.
 - 2. Apply primer for interior finish paint to following surfaces not receiving other coating:
 - a. Members shown on the structural drawings that do not receive spray fireproofing.
 - b. Surfaces permanently exposed on interior.
 - 3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
 - 4. Apply in accordance with paint manufacturer's instructions.
 - a. Apply minimum 0.002 IN, dry film thickness.
 - 5. Finish Paint for Surfaces Permanently Exposed on Interior (applied in field): Specified in Section 09 91 23.

PART 3 - EXECUTION

3.1 ERECTION

- A. Safety:
 - 1. Contractor is solely responsible for safety. Construction means and methods and sequencing of work is the prerogative of the Contractor.
- B. Capacity of partially complete construction:
 - 1. Consider that full structural capacity of many structural members is not realized until structural assembly is complete; That is, until slabs, decks and diagonal braces are installed. Partially complete structural members shall not be loaded out of sequence without an investigation.
 - 2. Until elements of the permanent lateral bracing system of the structure are complete, temporary lateral bracing for the partially complete structure will be required.
- C. Temporary bracing:
 - 1. Adequate temporary bracing to provide stability and resist loads to which the partially complete structure may be subjected to including construction activities and operation of equipment is the responsibility of the Contractor.
 - 2. If not obvious from the drawings, confer with the Architect to identify those structural elements that must be complete before the structure's permanent lateral bracing system is effective. The design of the temporary bracing system must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel frame by partially or completely installed work of other trades. Do not remove temporary bracing until the permanent lateral bracing system is effective.
- D. General:
 - 1. Set base and bearing plates accurately and grout immediately as indicated.
 - a. Use metal wedges, shims or setting nuts as required.
 - b. Pack grout solidly between plate and bearing surface.
 - 2. Clean bearing and contact surfaces before assembly.
- E. Install A325SC bolts with washers. Install and tighten in accordance with the RCSC Specifications or in accordance with manufacturer's instructions when twist-off bolts are used.
- F. Field weld as specified in paragraph "Welding."
- G. Do not use gas cutting to correct fabrication errors on major members.

1. Gas cutting on minor members may be permitted when members are not loaded, only after approval by Architect.
- H. Tighten and leave in place erection bolts used in welded construction.
- I. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1:20 with a plane normal to bolt axis.
- J. After installation, touch up damaged or abraded areas of primed steel using same materials used for shop priming.
 1. Clean field welds, bolted connections and abraded areas before touching up.

END OF SECTION

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SECTION 05 36 00
COMPOSITE METAL FORM DECK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Composite Metal Form Deck, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Standards:
 - 1. AISI; Specification for Design of Cold-Formed Steel Structural Members.
 - 2. ANSI/AWS-D1.3; Structural Welding Code - Sheet Steel.
 - 3. SDI; Design manual for composite decks, form decks and roof decks.
- B. Qualify welding processes and welding operators in accord with AWS qualification procedures.
- C. Minimum thickness:
 - 1. Where gage of metal is indicated, provide following minimum uncoated steel thickness, unless following performance requirements require greater thickness.

Gage	Minimum Thickness
20	0.034 IN
19	0.040 IN
18	0.045 IN
17	0.051 IN
16	0.057 IN

- D. Performance requirements:
 - 1. Provide form deck to act as bottom form for cast-in-place concrete slabs and which will become positive slab reinforcement through mechanical anchorage after concrete hardens.
 - 2. Provide deck thickness such that maximum deck stress shall not exceed 0.6 its yield strength under combined weights of wet concrete(including weight of additional concrete due to structural deflection of deck and beams), deck, and construction live loading of either 20 PSF uniform load or 150 LB concentrated load on a 1 FT wide section of deck. Base calculations on an assumed deflection of the structural steel beam results in 1 inch of deflection at center of bay.
 - 3. Provide deck with adequate thickness to limit maximum deflection relative to supporting structural members to 1/180 of clear span or 3/4 IN whichever is smaller, caused by combined weights of wet concrete and deck.
 - 4. Gage of deck furnished shall not be less than that indicated on the drawings.
 - 5. Provide deck units listed for Design No. D916 of Underwriter's Laboratories "Fire Resistance Index," current edition. Identify steel deck bundles with labels bearing UL mark.
 - 6. Configuration, physical and chemical properties and composite superimposed load carrying capacity of deck units furnished shall conform to manufacturer's catalog current at time bids are received.
 - 7. Provide accessories (pour stops, column closures, end closures, cover plates, and girder fillers) as needed to prevent concrete leakage.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's load tables for deck to be furnished on this project.
- B. Shop Drawings:
 - 1. Complete layout indicating types of deck panels, anchorage, supplementary framing, cut openings, accessories, deck thicknesses.
 - 2. Indicate areas requiring shoring on the shop drawings
- C. Product Information
 - 1. Manufacturer's Certification signed by the manufacturer indicating that the supplied products conform the specified requirements including those noted in 1.2.D.
 - 2. Manufacturers analysis of unshored span limits
 - 3. Shoring design and documentation prepared by a Licensed Structural Engineer
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers and designations:
 - 1. Composite metal form deck, 2 IN:
 - a. Base:
 - 1) Vulcraft; Type 2 VLI.
 - b. Optional:
 - 1) United Steel Deck, 2 IN Lok
 - 2) Wheeling Corrugated Deck 2.0SB
- B. Composite metal form deck:
 - 1. Deck shall be cold formed from steel sheets, conforming to ASTM-A653, Structural Quality, Grade-40 minimum with G60 coating.
- C. Accessories:
 - 1. Sheet steel closures, cover plates and other sheet steel accessories: Use same material and coating as for deck.

2.2 FABRICATION

- A. Where possible, deck shall extend over three or more spans with butted end laps.
- B. Form closures and cover plates to configuration required to form concrete and/or to prevent concrete leakage.
- C. End laps and accessories shall be located and be of a style so as not to reduce capacity of field applied studs for composite beams.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which deck units are to be installed for conditions detrimental to proper and timely completion of work.
- B. Correct unsatisfactory conditions.

3.2 INSTALLATION

- A. General:
 - 1. Do not overload supporting members.
 - 2. Unless specifically noted otherwise, provide composite metal form deck for concrete slabs supported directly or indirectly by structural steel frame.
 - 3. Install deck units and accessories in accordance with final shop drawings and as specified herein.
 - 4. Do not start placing units before supporting members are completely installed in place.
 - 5. Bear deck units on supporting members minimum of 2 IN. Butt units tightly together at centerline of support. Place abutting units in accurate and close alignment for entire length of run.
 - 6. Neatly cut and fit deck units and accessories around columns, walls, and other objects projecting through or adjacent to deck. Install closures and cover plates as required to prevent concrete leakage.
 - 7. Install shoring where indicated on shop drawings
- B. Openings:
 - 1. Deliver deck to job site intact when openings in deck are indicated on drawings to be installed after concrete fill is cured. Openings installed in this manner shall be paid for by trade requiring opening.
 - 2. Where openings in floor are framed, deliver deck to job site cut to proper length.
- C. Fastening – Welded Connectors:
 - 1. For welding deck to supports, employ only welders, qualified under AWS qualification procedures, and experienced in welding light gauge metal.
 - 2. Minimum deck fastening requirements:
 - a. At end of each unit and at intermediate supports: Puddle welds at 12 IN on center with not less than 2 welds per support.
 - b. At exterior beam parallel to deck span: Puddle welds or 1-1/4 IN seam welds at 18 IN on center.
 - c. At male-female side laps, 1-1/2 IN long seam welds or button punching at 18 IN on center.
 - d. At lapped side laps, 1-1/2 IN long seam welds at 18 IN on center.
 - e. Sheet metal closures, cover plates: Self-drilling screws or tack welds at 24 IN on center.
 - 3. Verify that minimum deck fastening requirements are adequate for safely supporting material and construction loads placed on deck from time of deck placement to time of concrete placement. Additional fastening required to accomplish this shall be provided and paid for by Contractor.
 - 4. Puddle welds shall have effective fusion diameter not less than 1/2 IN. Weld metal shall penetrate layers of deck material at end laps and be thoroughly fused to supporting members.

END OF SECTION

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SECTION 05 45 23
EQUIPMENT SUPPORT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Equipment Support System in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer active in metal framing business for 5 years.
 - 1. Maintain quality assurance program.
 - 2. Submit mill test reports for material.
- B. Specifications for Design of Cold Formed Steel Structural Members: AISI.
- C. Manual of Steel Construction: AISC.
- D. Resistance welding: AWS-C1.1.
- E. Welding sheet steel in structures: AWS-D1.3.
- F. As a part of this work: Provide engineering design and calculations, performed and sealed by registered Structural Engineer (SE), licensed in the State of Illinois.
- G. Design criteria:
 - 1. Support structure: As indicated.
 - a. Universal grid system. Provide universal grid system providing continuous support channels of spacing indicated in direction noted for each space. Locate first and last support channels 6 IN from inside face of walls parallel with universal grid direction.
 - b. For equipment support systems requiring higher loadings, see Drawings.
 - c. System to allow attachment of equipment support rails at any point without drilling or welding.
 - d. Maximum Spacing:
 - 1) 24 IN OC (unless otherwise indicated).
 - 2. Ceiling anchorage: Attach to structure by means of embedded concrete inserts or by direct attachment to structural framing.
 - a. If expansion anchors are used to anchor metal framing to support structure locate in manner that anchor bolt is loaded in shear.
 - b. Expansion anchors in tension are not permitted without Architect's approval.
 - 3. Design Loading:
 - a. Vertical: Design support structure to support the larger of either the proposed equipment load or minimum concentrated load of 1200 LBS at any point on each equipment track. Equipment load is maximum that will be encountered by positioning of equipment at extremities of its travel (maximal load configuration).
 - b. Lateral: Design bracing for support structure to resist a lateral load equivalent to 2 percent of the Vertical Design Load.
 - 4. Safety factor: Design support structure for minimum safety factor of at least 3 based on ultimate strength under static loading conditions. Do not allow structure to deflect more than 1/720 span in either plane (vertical or horizontal) when maximal loading conditions, due to equipment operation, are applied.
- H. Allowable tolerances:
 - 1. Install supporting frame work plumb and true.

2. Assure mounting surfaces of support structure are horizontal within 1/32 IN in 24 IN and within 1/16 IN in 18 FT length.
 3. Elevation of one rail mounting surface to other within 1/16 IN in 24 IN length of rails.
- I. Manufacturer must have service office within 500 mile radius of project, which has been functioning with full time personnel for minimum of 5 years prior to bid date.

1.3 SUBMITTALS

- A. Product data:
1. Catalog data: Properties of section, parts details.
- B. Shop drawings:
1. Indicate plan layout, typical elevations, anchoring methods.
- C. Project information:
1. Address of nearest stocking dealer.
 2. Equipment manufacturer's design load data.
 3. Engineering design calculations sealed by registered Engineer, licensed to practice Structural Engineering in the State where project is located.
- D. LEED Information:
1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Equipment Support System:
1. Base:
 - a. Unistrut.
 2. Optional:
 - a. B-Line.
 - b. Hilti.
 - c. Thomas and Betts, Superstrut.

2.2 MATERIALS

- A. Framing material: ASTM-A1011 Grade-33 or ASTM-A1008 Grade-A, G90.
- B. Finish:
1. Framing members and fittings: Corrosion resistant acrylic paint.
 2. Hardware: Electrogalvanized, ASTM-B633 Type-3-SC1
- C. Bracing: Provide bracing to resist lateral design load.
- D. Accessories:
1. Channel covers:
 - a. Provide channel covers at exposed surfaces after radiology equipment and supports are installed.
 - b. Provide fittings, fasteners, clamps, and miscellaneous items to provide a complete and secure installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Take field measurements to assure support system can be installed without interference with structural framing, mechanical systems, plumbing, or other obstructions.
- B. Install equipment support structure in accordance with approved shop drawings.
- C. Install under supervision of manufacturer.
- D. Report modification to installation to Architect.

END OF SECTION

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SECTION 05 50 10
MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Miscellaneous Metal Fabrications, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Materials and operations standards:
 - 1. AAMA, Architectural Aluminum Manufacturer's Association.
 - 2. AISC, American Institute of Steel Construction.
 - 3. ASTM, American Society for Testing and Materials.
 - 4. AWS, American Welding Society.
 - 5. F.S., Federal Specifications.
 - 6. NAAMM, National Association of Architectural Metals Manufacturers.

1.3 SUBMITTALS

- A. Shop drawings.
- B. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Materials listed:
 - 1. Base: As noted.
- B. Galvanizing Repair Paint:
 - 1. Base:
 - a. ZRC Worldwide.
 - 2. Optional:
 - a. Tnemec.
- C. Shop Primer:
 - 1. Base:
 - a. Sherwin-Williams.
 - 2. Optional:
 - a. Tnemec.
- D. Non-shrink Grout:
 - 1. Base:

- a. Dayton Superior Corporation.
- 2. Optional:
 - a. Sauereisen.
 - b. Minwax.
- E. Decorative Bollard Covers:
 - 1. Base:
 - a. Thermoprene.
- F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIAL

- A. Structural steel:
 - 1. Steel, Structural “W” shapes and tee’s: ASTM–A992 (50ksi yield point)
 - 2. Other steel shapes and plate: ASTM-A36
 - 3. Pipe – Round ASTM A500 Grade B (42ksi minimum)
 - 4. Tubing square or rectangular: ASTM-A500, grade-B (46ksi minimum)
- B. Cast steel: ASTM-A27, Grade-65-35; and ASTM-A148, Grade-80-50.
- C. Steel forgings: ASTM-A668.
- D. Bolts: ASTM-A307, ASTM-A325, ASTM-A354.
- E. Filler metal: AWS Standards.
- F. Cast iron: ASTM-A48, Class 30, minimum 30,000 PSI tensile.
- G. Malleable iron: ASTM-A47 and ASTM-A197.
- H. Aluminum: ASTM-B308 for particular alloy in standard shapes and extrusions, ASTM-B26 for castings.
- I. Stainless steel: ASTM-A484 and ASTM-A276.
 - 1. Concealed: Type 302 or Type 304.
 - 2. Exposed: Type 304.
 - a. Finish: ASTM-A480 AISI finish #4, unless otherwise indicated.
- J. Anchorage devices - masonry:
 - 1. Standard manufactured items.
 - 2. Lead expansion shields for machine screws and bolts 1/4 IN and smaller: Head out embedded nut type.
 - 3. For machine screws and bolts larger than 1/4 IN: Manufacturers’ standard.
 - 4. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.
 - 5. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.
- K. Fasteners:
 - 1. Galvanized or stainless where built into exterior walls.
 - 2. Select fasteners for type, grade and class required.
 - 3. Bolts and Nuts: Regular hexagon head ASTM-A307, Grade-A.
 - 4. Lag Bolts: Square or octagonal head type.
 - 5. Machine Screws: Cadmium plated steel.
 - 6. Wood Screws: Flat head carbon steel.
 - 7. Plain Washers: Round, carbon steel.
 - 8. Lock Washers: Helical spring carbon steel.
- L. Non-shrink grout:
 - 1. Compressive strength: 9000 PSI at 7 days.
 - 2. Base Product: 1107 Advantage Grout by Dayton Superior.

2.3 FABRICATION

- A. Form to shapes indicated with straight lines, sharp angles, and smooth curves.
- B. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
- C. Make permanent shop and field connections with continuous fillet type welds.
- D. Grind exposed welds smooth.
- E. Conceal fastenings where practicable.
- F. Shop fabricate in as large assemblies as practicable.
- G. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.
- H. Qualify welding processes and welding operators in accord with AWS.

2.4 SURFACE PREPARATION AND SHOP-APPLIED COATINGS

- A. General:
 - 1. All items in this section shall be shop finished by one of the methods described in this article.
 - a. Exceptions:
 - 1) Do not coat surfaces scheduled to be fireproofed with spray-on material.
 - 2) Do not coat machined surfaces, surfaces adjacent to field welds, contact surfaces of bolt connections where connection is specified as slip critical and top flanges of beams to receive shear connectors.
- B. Shop Primer for Interior (non-wet) Items:
 - 1. Primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series.
 - 2. Apply primer for interior finish paint to following surfaces not receiving other coating:
 - a. Surfaces exposed on interior.
 - 3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
 - 4. Apply in accordance with paint manufacturer's instructions.
 - a. Apply minimum 0.002 IN, dry film thickness.
 - 5. Finish Paint (applied in field): Specified in Section 09 91 23.
- C. Hot-dip Galvanized (HDG) Coating for Exterior items:
 - 1. Galvanize (HDG) the following items:
 - a. Items to be installed on site, roof or other areas that are "outside" of building enclosure walls. This shall include items "attached to" exterior walls of building.
 - b. Items to be installed in "wet" or humid (>70% RH) areas of building.
 - c. Partial listing of items to receive HDG:
 - 1) Masonry lintels, ledge angles and shelf angles.
 - 2) Pipe Bollards.
 - 3) Exterior Ladders, Stairs and railings.
 - 4) Exterior gratings and substructure.
 - 5) Exterior equipment supports.
 - 6) Similar items which are exposed to weather or built-in to Exterior walls.
 - 7) Other items indicated.
 - 2. Clean thoroughly before galvanizing.
 - 3. Galvanize in accordance with ASTM-A123.

2.5 PAINTING

- A. Paint exterior steel items (in field) as Specified in Section 09 91 13.
- B. Paint interior steel items (in field) as Specified in Section 09 91 23.

2.6 METAL FABRICATIONS

- A. General:
 - 1. Supply items required to complete construction and installation.
 - 2. Minimum Workmanship Standards (unless noted otherwise): Class 1 (Architectural) per NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
 - 3. Anchorage accessories:
 - a. Items required to secure wood to metal, wood to masonry, metals to masonry or concrete, metal to metal or metal to other items.
- B. Ladders:
 - 1. General:
 - a. Design to comply with the following regulations:
 - 1) ANSI-A14.3.
 - 2) OSHA 29 1910.27.
 - b. Material:
 - 1) Exterior Ladders: Galvanized steel, painted by Section 09 91 13.
 - 2) Interior Ladders: Shop-primed steel, painted by Section 09 91 23.
 - c. Side rail members: Minimum 1/2 x 2 IN.
 - d. Rungs: Minimum 7/8 IN round or square bars.
 - e. Punch rungs through side rails and weld.
 - f. Size to support concentrated moving load of 200 LB.
 - g. Minimum clearance from centerline of rung to wall or obstruction: 7 IN.
 - h. Minimum ladder width: 16 IN between side rails.
 - i. Rung spacing: 12 IN O.C.
 - j. Apply abrasive warning tape Type 2 to top and bottom rung of all ladders.
 - 2. Elevator Pit Ladders:
 - a. Comply with general items above, except as amended by the following:
 - b. Extend from bottom of pit to 4 FT above floor level.
 - c. Rungs: Minimum 3/4 IN round or square bars.
 - d. Maximum projection from wall: 5 IN or as otherwise limited by locally adopted codes and elevator running clearances.
 - e. Comply with ANSI/ASME-A17.1.
 - f. Coordinate final dimensions and locations with Elevator contractor.
- C. Metal Gratings:
 - 1. Complying with NAAMM "Metal Bar Grating Manual."
 - 2. Material and Thickness (except were otherwise indicated):
 - a. Galvanized steel, nominal 1-1/2 IN thick.
 - 3. Load Capacity: Support minimum uniform load of 200 PSF.
 - 4. Provide hold down clips.
 - 5. Serrated or slip resistant tops.
 - 6. Furnish with frames and support items of comparable material and finish.
- D. Steel Support Angles, Members and Loose Lintels:
 - 1. ASTM-A36 steel, Sizes and configurations as indicated.
 - 2. Items to be HDG (galvanized):
 - a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
 - b. Items set into exterior walls.
 - 3. Shop Prime interior items (in non-wet areas).
- E. Miscellaneous Equipment Supports:
 - 1. ASTM-A36 steel, Sizes and configurations as indicated.
 - 2. Examples of items included:
 - a. Support of electrical panels in Service Cores.
 - b. Overhead service carrier supports in laboratories.
 - c. Ceiling hung toilet partitions.
 - d. Other miscellaneous support items as indicated.

3. Items to be HDG (galvanized):
 - a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
 - b. Items set into exterior walls.
4. Shop Prime interior items (in non-wet areas).

2.7 BOLLARDS

- A. General:
 1. Provide where indicated.
 2. Supply items required to complete construction and installation.
 3. Minimum Workmanship Standards (unless noted otherwise): Class 1 (Architectural) per NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
- B. Type **DB-1** (Steel Bollards with Decorative Cover):
 1. Assembly including a concrete-filled steel pipe with a decorative cover sleeve.
 2. Steel pipe bollard:
 - a. 6 IN diameter extra strength, HDG (galvanized), steel pipe.
 - b. Length: Unless otherwise indicated; minimum 42 IN projection above ground and 36 IN embedment into concrete.
 - c. Fabricate with welded on anchors.
 - d. Fill with 3000 PSI concrete, flush at top.
 3. Decorative Bollard Covers:
 - a. Description: 1/8 IN thick, HDPE.
 - b. Size as appropriate for pipe.
 - c. Color: To be selected by Architect.
 - 1) 5-year warranty for color-fastness, cracking and UV-resistance.
 - d. Dual reflective stripes near top of cover.
 - e. Base Product: "Bollardgard" by Thermoprene.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.
- C. Ensure that adequate Wall Backing (as specified in Section 09 22 16) has been installed where required for wall-mounted items specified in this Section.

3.2 INSTALLATION

- A. General:
 1. Set work level, true to line, plumb.
 2. Shim and grout as necessary.
 3. Weld field connections and grind smooth.
 4. Where practical, conceal fastenings.
 5. Secure metal to wood with lag screws of adequate size with appropriate washers.
 6. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
 - a. Use expansion bolts, toggle bolts, or screws for light duty service.
 7. Meet structural requirements for erecting items of structural nature.
 8. Do not field splice fabricated items unless size requires splicing.
 9. Weld splices.
 10. Provide fabricated items complete with attachment devices as required to install.
- B. Galvanic Repair:
 1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.

2. Surface preparation: Remove contaminates in accord with SSPC SP-1.

C. Bollards:

1. Direct-buried: Prepare hole in earth which is at least:
 - a. Hole Depth: 6 IN deeper than embedment length specified for bollard.
 - b. Hole Diameter: 24 IN in diameter for 6 IN diameter pipes.
 - c. Set pipe bollards plumb and to the exposure height indicated.
2. Surface-Bolted and other means of attachment: Install as detailed.
3. Fill annular space with concrete fill having a compressive strength of at least 3000 PSI.
4. Paint or cover with decorative sleeves as scheduled.

3.3 FIELD PAINTING

A. All items in this section which are exposed to view:

1. Painting of exterior items: Specified in Section 09 91 13.
2. Painting of interior items: Specified in Section 09 91 23.

END OF SECTION

SECTION 05 50 13
STEEL STAIRS AND RAILINGS (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Steel Stairs and Railings, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design Responsibility:
 - 1. Engineering design submittal must be performed by, or under direct supervision of, registered Structural Engineer, licensed in State of Illinois.
 - 2. Submittal must include calculations for all load-bearing components of stairs and landings.
 - a. Indicate design live loads on submittal.
 - 3. Submittal to be reviewed by Architect for general conformance with design intent shown by Contract Documents.
 - a. Physical adequacy of Structural design and conformance with applicable building Codes are responsibility of stair fabricator.
- B. Materials and operations standards:
 - 1. AAMA, Architectural Aluminum Manufacturer's Association.
 - 2. AISC, American Institute of Steel Construction.
 - 3. ASTM, American Society for Testing and Materials.
 - 4. AWS, American Welding Society.
 - 5. F.S., Federal Specifications.
 - 6. NAAMM, National Association of Architectural Metals Manufacturers.
 - 7. NOMMA, National Ornamental & Miscellaneous Metals Association.
- C. Minimum Workmanship Standards, unless noted otherwise:
 - 1. Fabricate in accordance with latest editions of NAAMM AMP 521, Pipe Railings Systems Manual, and NAAMM AMP-510, Metal Stairs Manual.
 - 2. Railing System Joints: Continuous fillet weld. Type 1 Railing System Joint Construction.

1.3 SUBMITTALS

- A. Shop drawings.
- B. Project Information:
 - 1. Engineering design calculations, sealed by registered Engineer, licensed to practice Structural Engineering in state where project is located.
- C. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Galvanizing Repair Paint:
 - 1. Base:
 - a. ZRC Worldwide.
 - 2. Optional:
 - a. Tnemec.
- B. Shop Primer:
 - 1. Base:
 - a. Sherwin-Williams.
 - 2. Optional:
 - a. Tnemec.
- C. Coal Tar Epoxy:
 - 1. Base:
 - a. Tnemec.
 - 2. Optional:
 - a. ICI Dulux Paint Centers.
- D. Non-shrink Grout:
 - 1. Base:
 - a. Dayton Superior Corporation.
 - 2. Optional:
 - a. Sauereisen.
 - b. Minwax.
- E. Abrasive Warning Tape:
 - 1. Base:
 - a. 3M.
- F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Structural steel: ASTM-A36, ASTM-A501, ASTM-A575 or ASTM-A108.
- B. Cast steel: ASTM-A27, Grade-65-35; and ASTM-A148, Grade-80-50.
- C. Steel forgings: ASTM-A668.
- D. Bolts: ASTM-A307, ASTM-A325, ASTM-A354.
- E. Filler metal: AWS Standards.
- F. Cast iron: ASTM-A48, Class 30, minimum 30,000 PSI tensile.
- G. Malleable iron: ASTM-A47 and ASTM-A197.
- H. Steel pipe: ASTM-A53.
- I. Non-shrink Grout:
 - 1. Compressive strength: 8,475 PSI at 7 days.
 - 2. Base Product: 1107 Advantage Grout by Dayton Superior Corporation.
- J. Anchorage devices - masonry:
 - 1. Standard manufactured items.
 - 2. Lead expansion shields for machine screws and bolts 1/4 IN and smaller: Head out embedded nut type.
 - 3. For machine screws and bolts larger than 1/4 IN: Manufacturers' standard.
 - 4. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.

5. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.

K. Fasteners:

1. Galvanized or stainless where built into exterior walls.
2. Select fasteners for type, grade, and class required.
3. Bolts and Nuts: Regular hexagon head ASTM-A307, Grade-A.
4. Lag Bolts: Square or octagonal head type.
5. Machine Screws: Cadmium plated steel.
6. Wood Screws: Flat head carbon steel.
7. Plain Washers: Round, carbon steel.
8. Lock Washers: Helical spring carbon steel.

2.3 STEEL STAIRS

A. General:

1. Supply items required for complete construction and installation.
2. Minimum Workmanship Standards, unless noted otherwise:
 - a. Enclosed Stairs: Commercial Class per latest edition NAAMM AMP-510, Metal Stairs Manual.
3. Anchorage accessories:
 - a. Items required to secure wood to metal, wood to masonry, metals to masonry, or concrete, metal-to-metal or metal to other items.

B. Shop-fabricated Steel Pan Stairs

1. Fabricated as indicated.
2. Stringers: Channel shape, min. 12 IN deep.
3. Treads: Minimum 14 GA steel pans with self-furring diamond mesh metal lath welded in pan.
4. Risers: Minimum 14 GA.
5. Landings: Minimum 10 GA pans with angle supports as required, with self-furring diamond mesh metal lath welded in pan.
6. Supports: Support stairs at locations indicated. Outside stringers shall span flight length plus landing. Intermediate supports are not allowed without prior approval.
 - a. Hangers: Minimum 1/2 diameter.
 - 1) Connect hangers to structure with through-bolt type connections when in tension. Recess top plate and nut in slab and grout smooth. Expansion anchor type connections in tension are not allowed.
 - b. Support brackets and posts: Attach to structure as required, use welded connections whenever possible. When required, expansion anchors in concrete shall only be used for shear type connections.
7. Fabricate and design stair and landing assembly to support a 1000 LB concentrated, moving load, or 100 PSF, whichever requires stronger component.
8. Fabricate and design stair components in accordance with NAAMM Metal Stairs Manual.
9. Design, fabricate, and install in compliance with applicable codes.
10. Form surface with slip resistant materials: See Section 03 35 00.
11. Contractor's option: Provide factory manufactured stair system in lieu of fabricated stairs, subject to review by Architect.
12. Apply abrasive warning tape Type 1 to first and last nosing (at top and bottom) of all stair runs.

2.4 HANDRAILS AND GUARDRAILS

A. General:

1. Supply items required to complete construction and installation.
2. Use galvanized steel at exterior systems.
3. Form to profiles indicated.
4. Anchorage accessories:

- a. Items required to secure wood to metal, wood to masonry, metals to masonry or concrete, metal-to-metal or metal to other items.
- B. Design Criteria:
- 1. Comply with current approved building codes and amendments.
 - 2. Handrails and top rail of Guardrails, Uniform Load: 50 LBS/LF minimum applied in any direction.
 - 3. Handrails, Concentrated Load: 250 LBS minimum applied in any direction at any point along rail.
 - 4. Guardrail, Concentrated Load: 200 LBS minimum applied in any direction at any point along rail.
 - 5. Uniform and Concentrated Loads need not be concurrently applied.
 - 6. Intermediate rails, pickets, panels, balusters, and other infill materials:
 - a. Design to withstand a horizontally applied normal load of 50 LBS minimum on an area not to exceed 1 square foot including openings and space between rails.
 - 7. Utilize above listed loads for design of indicated members and their direct or indirect connection to building superstructure.

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- C. Handrails and Guardrails:
- 1. Minimum Clearance from wall: 2-1/4 IN.
 - 2. Maximum projection from wall: 4-1/2 IN.
 - 3. Set mounting brackets and posts maximum 8 FT O.C.
 - 4. Return ends of wall mounted rails to wall.
 - 5. Make rails smooth with no projections to prevent a hand from sliding along entire length.
 - 6. Handrail Member Size:
 - a. Round Tubing: HSS 1.50.x 0.083; ASTM-A500.
 - b. Round Tubing: HSS 1.50 x 0.083; Type 304 Stainless Steel; ASTM 249.
 - 7. Guardrail Member Sizes:
 - a. General:
 - 1) Following member sizes are minimum.
 - 2) Sizes shall be increased where appropriate to resist design loads.
 - 3) Refer to drawings for depiction of guardrails.
 - 8. Posts:
 - a. Round Tubing:
 - 1) HSS 1.66.x 0.140; ASTM-A500.
 - 2) Schedule 40 Pipe: 1-1/4 IN STD; ASTM-A53 is also acceptable.
 - b. Steel Plate:
 - 1) 4 IN wide x 3/4 IN thick.
 - 9. Toprails and Bottomrails:
 - a. Round Tubing:
 - 1) HSS 1.66.x 0.140; ASTM-A500.
 - 2) Schedule 40 Pipe: 1-1/4 IN STD; ASTM-A53 is also acceptable.
 - b. Steel Plate:
 - 1) 4 IN wide x 3/4 IN thick.
 - 10. Pickets:
 - a. Round Bar: 1/2 IN.
 - 11. Intermediate rails: At service areas only.
 - a. Round Tubing:
 - 1) HSS 1.50.x 0.083; ASTM-A500.
 - 2) Schedule 40 Pipe: 1 IN STD; ASTM-A53 is also acceptable.

2.5 MISCELLANEOUS ITEMS

2.6 FABRICATION

- A. Form to shapes indicated with straight lines, sharp angles, and smooth curves.

- B. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
- C. Qualify welding processes and welding operators in accord with American Welding Society.
- D. Make permanent shop and field connections with continuous fillet type welds.
- E. Grind exposed welds smooth and blend seamlessly into pipe.
- F. Conceal fastenings where practicable.
- G. Shop fabricate in as large assemblies as practicable.
- H. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.

2.7 SURFACE PREPARATION AND SHOP APPLIED COATINGS

- A. General:
 - 1. All items in this section shall be shop finished by one of methods described in this Article.
- B. Shop Primer for Interior (non-wet) Items:
 - 1. Primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series.
 - 2. Apply primer for interior finish paint to following surfaces not receiving other coating:
 - a. Surfaces exposed on interior.
 - 3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
 - 4. Apply in accordance with paint manufacturer's instructions.
 - a. Apply minimum 0.002 IN, dry film thickness.
 - 5. Finish Paint; applied in field: Specified in Section 09 91 23.
- C. Hot-dip Galvanized Coating for Exterior items:
 - 1. Galvanize following items:
 - a. Items to be installed on site, roof or other areas that are outside of building enclosure walls. This shall include items attached to exterior walls of building.
 - b. Items to be installed in wet or humid, greater than 70 percent RH, areas of building.
 - 2. Clean thoroughly before galvanizing.
 - 3. Galvanize in accordance with ASTM-A123.

2.8 PAINTING

- A. Paint exterior steel items in field as Specified in Section 09 91 13.
- B. Paint interior steel items in field as Specified in Section 09 91 23.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.
- C. Ensure that adequate wall backing has been installed where required for handrails and similar wall-mounted items specified in this Section.

3.2 INSTALLATION

- A. General:
 - 1. Set work level, true to line, and plumb.
 - 2. Shim and grout as necessary.
 - 3. Weld field connections and grind smooth.
 - 4. Where practical, conceal fastenings.

5. Secure metal to wood with lag screws of adequate size with appropriate washers.
 6. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
 - a. Use expansion bolts, toggle bolts, or screws for light duty service.
 7. Meet structural requirements for erecting items of structural nature.
 8. Do not field splice fabricated items unless size requires splicing.
 9. Weld splices.
 10. Provide fabricated items complete with attachment devices as required to install.
- B. Galvanic Repair:
1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
 2. Surface preparation: Remove contaminants in accord with SSPC SP-1.
- C. Handrails:
1. Furnish handrails complete with brackets.
 2. Coordinate locations and installation of wall backing.
 3. Where posts are indicated to be set in sleeves, provide galvanized steel sleeves having a minimum wall thickness of 1/8 IN.
 4. Set pickets or posts in sleeves with non-shrink grout.
 5. Where setting is required for exterior, hold non-shrink grout back 1/4 IN from surface.
 6. Fill flush with sealant.
- D. Abrasive warning tapes:
1. Apply where indicated near end of construction, after job site has been cleaned and nearly ready for occupancy.
 2. Clean and prepare surfaces to receive tape prior to application.
 3. Apply tape only when ambient temperature is within manufacture's recommended limits.
 4. Where tape is damaged by construction activities, remove, clean, and reapply.

3.3 FIELD PAINTING

- A. All items in this section which are exposed to view:
1. Painting of interior and exterior items: Specified in Section 09 91 13.

END OF SECTION

SECTION 05 52 16
ORNAMENTAL EXTERIOR METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for exterior metal railings, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. References standards:
 - 1. Architectural Aluminum Manufacturer's Association (AAMA) for aluminum.
 - 2. American Society for Testing and Materials (ASTM).
- B. Design Responsibility - General:
 - 1. Engineering design submittal must be performed by, or under the direct supervision of, a registered Structural Engineer (SE), licensed in the State of Illinois.
 - 2. Submittal must include calculations for all rails, posts, pickets, and other load-resisting components:
 - a. Note design live loads on submittal.
 - 3. Submittal to be reviewed by Architect for general conformance with design intent as indicated:
 - a. Physical adequacy of Structural design, and conformance with applicable building Codes are the responsibility of the railing fabricator.
 - 4. Component sizes shall comply as indicated except larger/stronger members may be used where additional strength is required:
 - a. Demonstrate by calculations performed by qualified Engineer employed by the fabricator.
- C. Code Compliance:
 - 1. Design exterior railing system to comply with:
 - a. 2009 Edition of International Building Code.
 - b. ADA requirements.
- D. Top rails of guardrail systems shall be capable of withstanding the following loads applied as indicated:
 - 1. Concentrated load of 250 LB applied at ant point and in any direction.
 - 2. Uniform load of50 LB per linear FT applied horizontally and concurrently with uniform load of100 LB per linear FT applied vertically downward.
 - 3. Concentrated load need not be assumed to act concurrently with uniform loads.
- E. Handrails not serving as top rails shall be capable of withstanding the following loads applied as indicated:
 - 1. Concentrated load of 250 LB applied at any point and in any direction.
 - 2. Uniform dead load of50 LB per linear FT applied in any direction.
 - 3. Concentrated load need not be assumed to act concurrently with uniform loads.
- F. Guardrail systems shall be capable of withstanding a horizontal concentrated load of250 LB applied to any member in the system:
 - 1. Above load need not be assumed to act concurrently with loads on top rails of railing system in determining stress on guard.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product data, including description of materials, components, fabrication, and finishes.
- B. Shop Drawings:
 - 1. Including elevations, sections, and details, indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories, and installation.
 - 2. Indicate component details, materials, finishes, connection and joining methods.
 - 3. Show details of attaching railing system to supports.
- C. Project Information:
 - 1. Engineering design calculations, sealed by registered Engineer, licensed to practice Structural Engineering in state where project is located.
- D. Contract Closeout Information:
 - 1. Maintenance Instructions.
 - 2. Warranty.
- E. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Exterior Metal Railing System:
 - 1. Base:
 - a. Julius Blum & Co.; Carlstadt Aluminum Railing System
 - 2. Optional:
 - a. J.G. Braun.
 - b. Blumcraft of Pittsburgh.
 - c. HDI Railings
- B. Dissimilar metal protection coating:
 - 1. Base:
 - a. Tnemec.
- C. Grout, non-shrink:
 - 1. Base:
 - a. Minwax.
 - 2. Optional:
 - a. Sauereisen Cements Co.

2.2 MATERIALS

- A. Aluminum:
 - 1. Alloy 6063-T52 for extruded pipe sections and posts in accord with ASTM-B221.
 - 2. Finish:
 - a. Clear anodized AA-M12-C22-A41 in accord with AAMA 606.1.
- B. Anchorage devices:

1. Furnish anchorage devices compatible with system and substrate.
- C. Grout, non-shrink:
 1. Compressive strength: 8,475 PSI at 7 days.
 2. Base Product: Minwax, Super Por-Rok.

2.3 FABRICATION

- A. Form to shapes and profiles indicated with straight lines, sharp angles, smooth curves.
- B. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
- C. Furnish minimum 5 IN matching sleeves or inserts for post systems set in concrete:
 1. Set inserts for posts at maximum 8 FT O.C. unless closer spacing is indicated.
- D. Conceal fastenings where practicable.
- E. Shop fabricate in as large assemblies as practicable.
- F. Provide dissimilar metal protection coating:
 1. When dissimilar metals come in contact.
 2. When aluminum is anchored to or in contact with concrete or masonry.
- G. Cut material square and remove burrs from exposed edges with no chamfer.
- H. Make rails smooth with no projections preventing a hand from sliding along entire length.
- I. Make exposed joints butt tight and flush.
- J. Close exposed ends of pipes or rails with end caps.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Set work level, true to line, plumb.
- B. Shim and grout as necessary.
- C. Where practical, conceal fastenings.
- D. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
- E. Meet structural requirements for erecting items of structural nature.
- F. Do not field splice fabricated items unless size requires splicing.
- G. Wherever posts are indicated to be set in sleeves, provide galvanized steel sleeves having a minimum wall thickness of 1/8 IN:
 1. Set posts in sleeves with non-shrink grout.
 2. Hold non-shrink grout back 1/4 IN from surface.
 3. Fill flush with sealant.
- H. Provide fabricated items complete with attachment devices as required to install.

3.3 CLEANING AND PROTECTION

- A. Protect railing systems during construction.

B. Clean prior to final acceptance.

END OF SECTION

SECTION 06 10 53
CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Carpentry, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Drawings indicate type, arrangement, and location of items of finish carpentry and millwork.
- B. If variations from arrangement or profile indicated are required, notify Architect.
- C. Make such variations at no added expense to Laboratory.
- D. Contractor is responsible for fitting to recesses, including trim pieces, fillers, and closures.
- E. Lumber grading rules and species:
 - 1. US Department of Commerce, DOC PS-20 – American Softwood Lumber Standard.
 - 2. Western Wood Products Association (WWPA).
 - 3. Southern Forest Products Association (SFPA).
- F. Certification of wood from sustainable forests:
 - 1. Forest Stewardship Council.
 - 2. Smart Wood.
- G. Plywood grading rules and recommendations:
 - 1. For softwood plywood: US Department of Commerce DOC PS-1 – Construction and Industrial Plywood.
 - 2. For hardwood plywood: US Department of Commerce DOC PS-51-71.
 - 3. American Plywood Association (APA).
- H. Factory marking:
 - 1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.
 - 2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark, and fire-retardant treatment, pressure-applied blue stain color code for identification.
 - 3. Standards for fire hazard classification and weathering for fire retardant treated material: Underwriters' Laboratories (UL), American Wood Preservers Institute (AWPI), and American Society for Testing and Materials (ASTM).
 - a. ASTM-E84: Standard Test Method for Surface Burning Characteristics.
 - b. ASTM-D2898: Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing.
 - 4. International Building Code requirements for identification and labeling.
- I. Preservative and fire retardant treatment standards: American Wood Preservers Association (AWPA):
 - 1. AWPA-U1: Treated Wood.
 - 2. AWPA P5: Standard for Waterborne Preservatives.

1.3 DEFINITIONS – FINISHED CABINETS

- A. Certified Wood:
 - 1. A voluntary third party certification in conformance with the Forest Stewardship Council criteria that timber harvested and processed meets forest management and ecological standards.

1.4 SUBMITTALS

- A. Product Data.
- B. Shop Drawings:
 - 1. Showing the fabrication and erection of each condition for architectural metal panels, including plans and elevations.
 - 2. Show anchorage and accessory items, finishes, framing and bracing members.
- C. Samples:
 - 1. Fabricated samples: Minimum quantity of 3, 8 x 10 IN samples of veneered metal panel.
 - a. Architect review shall establish and control criteria for color, texture, workmanship and joint tolerances only.
 - b. Submit additional samples as may be required for Architect's approval.
 - 2. Include shop-applied stains and transparent finishes, where applicable, on fabricated samples.
 - 3. Mock-up Wall, see below.
- D. Project Information:
 - 1. Certification of fire-retardant treatment including name of fire-retardant salts used, compliance with applicable building code requirements and with AWWA Spec C27B for plywood, and that treatment will not bleed through or attack final finish.
- E. Contract Closeout Information:
 - 1. Maintenance Data.
- F. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. MR 6.0, Rapidly Renewable Materials: Manufacturers' product data for products manufactured from rapidly renewable material; indicate type of rapidly renewable material.
 - 4. MR 7, Certified Wood: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body; include statement indicating costs for each certified wood product.
 - 5. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants, including printed statement of VOC content.
 - 6. EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Manufacturer's product data for each composite wood product used indicating that no urea formaldehyde is used in the production of the product.

1.5 SAMPLE WALL

- A. Sample Wall
 - 1. Prior to proceeding with work, erect sample typical of metal paneled wall.
 - 2. Based on approved materials.

3. Sample shall be used to obtain Architect's acceptance of visual qualities as well as materials and workmanship.
4. Accepted mock-up shall be protected and maintained as a standard for the balance of the work, and may be part of the permanent installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fire-retardant treated dimension lumber and plywood:
 1. Base:
 - a. Hoover Wood Treated Products, Inc.
 2. Optional:
 - a. Chemical Specialties.
 - b. Arch Wood Protection (Dricon).
- B. Metal Paneling:
 1. Base: As indicated in Room Finish and Color Schedule, Section 09 06 10.
- C. Mounting Clips:
 1. Base:
 - a. Brooklyn Hardware, LLC.
 2. Optional:
 - a. Monarch Manufacturing.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Dimensional Lumber and Plywood:
 1. General:
 - a. Thoroughly seasoned, non-treated, well-fabricated materials of longest practical lengths and sizes.
 - b. Free of non-correctable warp.
 - c. Discard material which would impair quality of work.
 2. Lumber Grading: Comply with dry size requirements of PS-20, Douglas fir WWPA No.3, or SFPA No.2.
 3. Plywood Grading: PS1, A-C Grade.
 4. Application, except where treated types are indicated:
 - a. General framing.
 - b. Blocking, backing, nailers, grounds, and similar members.
 - c. Other locations where indicated.
 - d. Plywood shall be FSC certified.
 - e. Plywood shall be manufactured without urea-formaldehyde binders.
- B. Fire-retardant Treated (FRT) Lumber and Plywood:
 1. General:
 - a. Fire-retardant-treated wood:
 - 1) ASTM-E84:
 - a) Flame spread index of 25 or less and no evidence of significant progressive combustion when the test is continued for an additional 20-minute period.
 - b) Flame front shall not progress more than 10.5 FT beyond the centerline of the burners at any time during the test.
 - b. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.

- c. Manufactured under the independent third party inspection of Underwriters Laboratories Inc. (UL).
 - d. Kiln dried after treatment to maximum moisture content of 19 percent for lumber and 15percent for plywood. Label each piece kiln dried after treatment "KDAT."
 - e. Lumber Grading:
 - 1) Comply with dry size requirements of PS-20, Douglas fir WWPA No.3, or SFPA No.2.
 - 2) Thoroughly seasoned, well-fabricated materials of longest practical lengths and sizes.
 - 3) Free of non-correctable warp.
 - 4) Discard material which would impair quality of work.
 - f. Plywood Grading: PS1, A-C Grade.
 - g. FSC certified.
2. FRT material for interior, above-grade Locations (typical):
- a. Base Product: Pyro-Guard by Hoover, or Dricon FRT by Dricon.
 - b. Natural wood products treated to add fire-retardant qualities.
 - c. Maximum equilibrium moisture content: Not more than 28 percent when tested in accordance with ASTM-D3201 at 92 percent relative humidity.
 - d. Application:
 - 1) Interior, above-grade framing, blocking, and sill plates within non-load bearing interior partitions that are fire rated 2 hours or less.
 - 2) Above-grade framing, blocking, and sill plates within non-load bearing exterior walls that are not fire-rated.
 - 3) Platforms and Stages.
 - 4) Wood in concealed spaces.
 - 5) Framing, blocking, cants and nailers within roof covering and waterproofing systems.
 - 6) Interior sleepers and sill plates in contact with concrete slabs-on-grade.
 - 7) Interior wood items in direct contact with exterior concrete and exterior masonry walls.
 - 8) Window frame blocking within exterior walls.
 - 9) Plywood backing panels for electrical, tele-communication equipment.
 - 10) Similar locations where wood products are indicated and building code does not permit non-FRT products.
 - 11) Exception: Upgrade to Exterior grade where schedules in the following article.
 - e. FSC certified.
3. FRT material for exterior and wet locations:
- a. Base: Exterior Fire-X by Hoover; Dricon FRX by Dricon.
 - b. Natural wood products treated to add fire-retardant qualities plus decay and termite resistance.
 - c. Treatment must be non-leaching under direct exposure to precipitation, sunlight, and effects of weather; No deterioration of Flame Spread Rating after undergoing rain test (ASTM-D2898).
 - d. Application (Exterior FRT):
 - 1) Fire-treated wood that is directly exposed to weather.
 - 2) Fire-treated wood in areas of high-humidity, >80 percent RH.
 - 3) Other areas where indicated.
- C. Sill Sealing Gaskets:
- 1. Closed cell neoprene foam.
 - 2. Nominal Thickness: 6.4mm 1/4 IN.
 - 3. Widths: matching width of sill members indicated.
- D. Adhesives for bonding furring, sleepers, and sills and similar items to concrete or masonry:
- 1. ASTM-D3498 product that is approved for use indicated by adhesive manufacturer.

2. Adhesives applied inside building envelope shall have a VOC content no greater than 70 g/L..
- E. Water-Repellent Preservative:
1. Usage: For treatment of exposed ends of posts and beams. Do not use for treating cuts in preservative-treated lumber or fire-retardant treated lumber.
 2. NWWDA tested and accepted formulation containing propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.
- F. Fasteners:
1. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 2. Anchorage and fastening materials: Proper type, size, material, and finish for application.
 3. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity:
 - a. Use fasteners with hot dip zinc coating complying with ASTM-A153.
 - b. Use fasteners of Type 304 stainless steel.
- G. Nails, Brads, and Staples: ASTM-F1667.
- H. Power-Driven Fasteners: NES NER-272.
- I. Wood Screws: ASME B18.6.1.
- J. Lag Bolts: ASME-B18.2.1.
- K. Bolts: ASTM-A307, Grade A steel bolts with ASTM-A563 hex nuts and washers.
- L. Expansion Anchors:
1. Anchor bolt and sleeve assembly capable of sustaining a load equal to 6 times the load imposed when installed in unit masonry assemblies and 4 times the load imposed when installed in concrete as determined by testing per ASTM-E488 conducted by a qualified independent testing and inspecting agency.
 2. Material:
 - a. Interior Applications: Carbon-steel components, zinc plated to comply with ASTM-B633, Class Fe/Zn 5.
 - b. Exterior and Wet Applications: Stainless Steel components, ASTM-F593 & F594 Alloy Group 1 or 2.
 - c. Zinc plated to comply with ASTM-B633, Class Fe/Zn 5.

2.3 MATERIALS — FINISH CARPENTRY

- A. Metal Clad Paneling (MP-1):
1. Particleboard core paneling finished on exterior with decorative steel.
 - a. Sizes and configurations as indicated.
 - b. AWI Section 500.
 - c. Fire rated: Class A.
 - d. Premium Grade.
 2. Steel facing material and edges:
 - a. Minimum 0.0250 IN thick.
 - b. Color:
 - 1) See Section 09 06 10.
 - a) Steel finish has directional quality – striping to run vertical, parallel to panel height.
 - 2) Alternate manufacturer must match patina, coating and overall look of metal panel finish specified in 09 06 10.
 - 3) Alternate manufacturer must provide lacquer coating that prohibits transfer of rust from panel, while also being able to break form at edges without cracking or chipping.

3. Plastic laminate backer sheet:
 - a. Minimum 0.048 IN thick.
 4. Adhesive: VOC content no greater than 80 g/L and containing no urea-formaldehyde resins.
 5. Particleboard core:
 - a. Thickness: 3/4 IN.
 - b. UL Class I.
 - 1) Fire rated: Flame spread 20, Smoke developed 450.
- B. Mounting Clips:
1. Fully concealed devices with mating edges; used to secure of metal panels to parent wall.
 - a. Permits installation of metal panels from finished side without exposed fasteners.
 - b. Capable of supporting panel's full dead load.
 - c. Limiting lateral movement in direction perpendicular to plane of parent wall.
 - d. Permitting longitudinal movement (parallel to plane of wall) caused by normal, seasonal humidity and temperature fluctuations.
 2. Material: Type 6005A Aluminum, treated to T5 hardness.
 3. Maximum thickness: 6.4mm 1/4 IN.
 4. Lift-off clearance: 16mm 5/8 IN.
 5. Fasteners:
 - a. No. 10, pan head screws, length as required.
 - b. Quantity and spacing as required.
 6. Base Product: "PanelClip" by Brooklyn Hardware, LLC.
 7. Optional: "Panel Z-Clip MF 375 – 2 IN" by Monarch Manufacturing.

2.4 FABRICATION – FINISHED PANELING

- A. Finish panel edges to match exterior surfaces.
- B. Assemble without use of exposed fasteners.
- C. Provide access panels if installed work covers mechanical, electrical or other items requiring access.
- D. Verify dimensions by accurate field measurement before fabrication wherever work adjoins other work that precede it in construction.
- E. Do not erect or install Paneling in areas until completion of work by other trades that might damage or disfigure the woodwork.
- F. Paneling shall be constructed in accordance with dimensions and design indicated.
- G. Tolerances on overall assembly dimensions shall comply with the applicable AWI standards.
- H. Workmanship:
 1. Work shall be fabricated and rigidly assembled.
 2. Reinforcing shall be provided to ensure a rigid and secure assembly.
 3. Exposed surfaces shall be free from dents, toll marks, warpage, buckle, glue and open joints.
 4. Joints, corners and miters shall be accurately fitted.
 5. Threaded connections shall be drawn tightly so that the threads are entirely concealed.
- I. Fastening:
 1. Attachment of panels to walls: By concealed mounting clips.
 2. Except where otherwise indicated, the methods of assembly and joining shall be in accordance with AWI standards..
 3. Manufacturer's proven methods that produce the required standards of workmanship shall be used.
- J. Assembly: Fit and assemble work in shop insofar as practicable.

1. Mark and disassemble units that are too large for shipment to project site, retaining units in sizes that are appropriate for shipment and erection.

PART 3 - EXECUTION

3.1 PREPARATION - ROUGH CARPENTRY

- A. Verify measurements, dimensions, and drawing details before proceeding.
- B. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
- C. Examine conditions under which work is to be installed.
- D. Correct unsatisfactory conditions.

3.2 INSTALLATION - ROUGH CARPENTRY

- A. Attach work securely by anchoring and fastening as indicated or required to support applied loading.
 1. Provide washers under bolt heads and nuts.
 2. Nail plywood in accordance with APA recommendations.
 3. Countersink nail heads.
- B. Set work to required levels and lines, plumb, true.
- C. Cut and fit accurately.
- D. Make connections tight.
 1. Use common wire nails or screws for general work.
 2. Use finishing nails for finish work.
 3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
 4. Install fasteners without splitting wood; predrill as required.
 5. Do not drive threaded friction type fasteners.
 6. Tighten bolts and lag screws at installation and retighten as required.
 7. Use galvanized nails and fasteners.
- E. Provide wood grounds, nailers, or blocking as required for attachment of other work and surface applied items.
- F. Form to shapes indicated.
- G. Provide wood blocking between studs at height of door stop, behind stop, at every door opening.
- H. Grounds: Dressed, key beveled lumber minimum 1-1/2 IN wide of thickness required to bring face of ground even with finish material.
- I. Remove temporary grounds when no longer required.
- J. Install wood furring plumb and level with closure strips at edges and openings.
- K. Shim as required.
- L. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWPA-M-4.
- M. Use only fasteners approved by the manufacturer of fire-retardant-treated or preservative treated wood.

3.3 INSTALLATION OF BLOCKING AND NAILERS FOR ROOFING AND PARAPETS

- A. General:
 1. Comply with ANSI/SPRI ES-1.

2. Minimum Member Size: 2x6 IN nominal .
 3. Fasteners:
 - a. Corrosion resistant.
 - b. Countersink heads of all fasteners.
 - c. Fastener types as required for substrate conditions.
 - d. Diameter and spacing as required to resist forces indicated.
 4. Fastener Spacing:
 - a. Threaded Anchor Bolts; 3/8 IN or larger:
 - 1) Utilize 5/8 IN OD washers or larger.
 - 2) Maximum Spacing: 48 IN.
 - 3) Stagger 1/3 the nailer width.
 - b. Other fastener types:
 - 1) Maximum Spacing:
 - a) Typical: 12 IN O.C.
 - b) Up to 16 IN O.C. where necessary to match spacing of structural members.
 - 2) Stagger 1/3 the nailer width.
 - 3) At ends of nailers lengths (including butt ends and terminal ends): Install 2 fasteners and within 6 IN of ends.
 5. Anchor nailers to resist minimum vertical force of 300 LBS/LF in any direction.
 - a. Locate fasteners approximately 4 IN from ends but not less than 3 IN.
 - b. Use minimum of 3 anchors for each nailer.
 - c. Where members are wider than 6 IN stagger fasteners from side to side to avoid splitting of the wood member.
 - d. Corner region enhancements:
 - 1) Double the above listed vertical force which must be resisted.
 - 2) Length and width of corners as prescribed by ANSI/SPRI RP-4:
 - a) 40 percent of the building height, but not less than 8-1/2 FT.
- B. Nailers used for perimeter securement of roofing membranes:
1. Install nailers where indicated and where required to secure perimeter of membrane roofing.
 2. Match height of nailers to adjacent insulation.
 3. Where multiple layers are required to match depth of insulation:
 - a. Attach base layer as indicated in "General Requirements" above.
 - b. Apply a bead of construction adhesive between laminations.
 - c. Attach subsequent layers using fastener type which is appropriate for wood-to-wood securement.
 - d. Size and locate fasteners as required to resist uplift loading indicated.
- C. Blocking used for securement of sheet metal edge flashings, parapet copings, and similar items:
1. Install blocking as indicated.
- D. Wall blocking:
1. Provide in-wall wood blocking reinforcement where following items are required to be wall-mounted to interior walls:
 - a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
 - b. Handrails at stairwells.
 - c. Wall-mounted door stops.
 2. Wood Blocking:
 - a. Within firewalls: Provide fire-treated material.
- E. Metal Wall Backing: Specified in Section 09 22 16 for walls utilizing metal stud construction.

3.4 INSTALLATION REQUIREMENTS - FIRE RETARDANT TREATED WOOD

- A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.
- B. Field Cuts:

1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
 - a. Cross cuts, joining cuts, and drilling holes are permitted.
2. Plywood: Fire retardant treated plywood may be cut in any direction.

3.5 INSTALLATION – FINISHED PANELING

- A. Prime paint or seal surfaces as recommended by manufacturer.
- B. Install paneling in compliance with manufacturer's recommendations and approved shop drawings.
- C. Assemble, fit and attach unassembled sections with concealed connections.
- D. Firmly secure paneling to ground, furring, framing, and other backings.
- E. Fit and scribe to adjacent materials accurately.
- F. Install paneling over wall surfaces by concealed clips.
- G. Maintain true, plumb, and level alignment of paneling throughout.
- H. Maintain reveals and exposed panel terminating edges in constant line and width.

3.6 INSPECTION

- A. Examine areas to receive work.
- B. Correct unsatisfactory conditions.
- C. Start of work constitutes acceptance of responsibility for performance.

3.7 ADJUST AND CLEAN

- A. Promptly remove debris, dirt, and rubbish.
- B. After installation, adjust operating parts.
- C. Leave items in perfect operating condition.
- D. Remove and replace rejected work.
- E. Install temporary coverings to protect installed work.

END OF SECTION

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SECTION 06 42 14
RECLAIMED FLUSH WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Reclaimed Flush Wood Paneling, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Architectural Woodwork Institute (AWI) workmanship standards for Finish Carpentry:
 - 1. Premium Grade Standards.
- B. Installer Qualifications:
 - 1. Experienced in successfully producing millwork similar to that indicated for this Project.
- C. Material:
 - 1. Compact and solid wood reclaimed from old barns, buildings and crates.
 - 2. Lead and toxin free.
- D. Drawings indicate type, arrangement, and location of items to construct paneling fabricated from reclaimed wood.
- E. If variations from arrangement or profile indicated are required, notify Architect.
- F. Make such variations at no added expense to Owner.
- G. Contractor is responsible for fitting to recesses, including trim pieces, fillers, and closures.
- H. Surface burning characteristics: ASTM-E84, Minimum Class C.

1.3 MOCK-UP WALL

- A. Prior to proceeding with work, erect sample typical of paneled wall.
 - 1. Construct based on approved materials and drawings.
 - 2. Sample shall be used to obtain Architect's acceptance of visual qualities as well as materials and workmanship.
 - 3. Accepted mock-up shall be protected and maintained as a standard for balance of work, and may be part of permanent installation.

1.4 SUBMITTALS

- A. Product Data.
- B. Shop Drawings:
 - 1. Show each condition for reclaimed flush wood paneling, including plans and elevations.
 - 2. Show, jointing, grain direction, anchorage and accessory items, finishes, framing and bracing members.
- C. Samples:
 - 1. Provide sample of each type of product indicative of size.
 - 2. Show full range of normal color, texture and millwork variations expected.
 - 3. Larger samples may be requested to further show grade characteristics.
 - 4. Include fire retardant transparent finishes on fabricated samples.
 - 5. Include stains and fire retardant transparent finishes on fabricated samples.
- D. Contract Closeout Information:

1. Maintenance Data.
- E. LEED Information:
1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.
 4. EQ 4.2, Low-Emitting Materials, Paints and Coatings: Manufacturers' product data indicating VOC content of all paints and coatings applied inside the building envelope.
 - a. Provide gallons applied for each coating.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Wood Paneling and other wood items:
1. Base:
 - a. Elmwood Reclaimed Timber.
 2. Optional:
 - a. Old Barn Reclaimed Wood Company
 - b. Viridian Wood Products.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIAL

- A. Reclaimed Wood Paneling:
1. Wood Species:

AD-4: Section 06 42 14: Revise paragraph 2.2.A.1.a.

- a. Mixed Softwood - Classic Mixed Grade
 2. Paneling Type:
 - a. Classic Antique.
 - 1) Antique lumber characteristics.
 - 2) Knot Content: Variable.
 - 3) Nail Holes: Variable.
 - 4) Heartwood Content: Variable.
 - 5) Varying degrees of defects and blemishes.
 3. Thickness: 1/2 IN.
 4. Length: ____FT.
 5. Edge Treatment: Ship-Lap.
- B. Adhesives:
1. Contact adhesive or other adhesive recommended by AWI Quality Standards for durable and permanent bond to suit application, including materials bonded, expansion and contraction, fire rating and moisture resistance.
 2. Contact adhesive shall have VOC content no greater than 80 g/l in accordance with SCAQMD Rule # 1168.

2.3 HARDWARE

- A. Fasteners:

1. Wood Screws: FS FF-S-111, type, size, material and finish as required for the condition of use.
2. Nails: FS FF-N-105, type, size and finish as required for use.
3. Anchors: Type, size, material and finish as required for substrate condition and adequate anchorage for work.

2.4 FABRICATION

- A. Paneling and Trim:
 1. Comply with AWI Premium Grade requirements.
 2. Field verify dimensions prior to fabrication.
 3. Form to profiles indicated.
 4. Reinforce work to ensure a rigid and secure assembly.
 5. Accurately fit joints, corners and miters.
 6. Draw trim tight against finished surface.
 7. Cope trim at returns and internal angles and miter at external angles.
 8. Kerf backs of wide flat members.
- B. Fastening:
 1. Comply with AWI Premium Grade requirements for assembly and joining, or as indicated.
 2. Conceal fastenings wherever possible.
 3. Where necessary, set exposed nails and close holes with filler to hide.

2.5 FINISHING

- A. See Section 09 91 23 for additional requirements.
- B. Fire Retardant Sealer and Stains:
 1. Base Manufacturer: Quantum.
 2. Sealer: American Fire Coatings: No 6-3.
 3. Finish Coat: Quantum Safecoat Clear
 4. Over Coat: Quantum Safecoat Clear Matte Reducer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine supporting structure and conditions under which Wood Paneling is to be installed for excessive moisture content.
- B. Correct conditions detrimental to satisfactory completion of work.
- C. Do not deliver wood products until concrete, masonry, plaster, ceramic tile and similar wet work is completely cured and dry.
- D. Maintain ambient temperature between 18 to 24 degC 65 to 75 degF in spaces to receive wood products for seven days prior to installation, during installation, and seven days after installation.
- E. Move wood products into spaces where it will be installed at least seven to ten days before installation.
- F. Do not install wood products until adjusted to relative humidity and temperature of space where installed.
- G. Verify dimensions before proceeding and obtain measurements at job site for work required to accurately fit with other construction.
- H. Coordinate work with that of other trades affected by installation.

3.2 INSTALLATION

- A. Apply two coats of sealer to back of paneling before installation.
- B. Install wood paneling in compliance with details and approved shop drawings.
- C. Assemble, fit and attach with concealed connections.
- D. Firmly secure wood paneling to ground, furring, framing, and other backings.
- E. Fit and scribe to adjacent materials accurately.
- F. Install wood paneling wood paneling true, plumb, and level with use of concealed fasteners.
- G. Maintain consistent alignment of reveals, jointing and trim.
- H. Maintain relative humidity and ambient temperature planned for building occupants.

3.3 FINISH PREPARATION

- A. Prepare surfaces to be finished in accordance with manufacturer's recommendations.
- B. Previously uncoated surfaces:
 - 1. Surfaces must be dry, clean, free of all wax, grease, dirt, sanding dust, etc.
 - 2. Seal with FC No. 5 clear wood sealer. Allow the surface to thoroughly dry before proceeding with the application of FC 166.
 - 3. Sealer VOC content shall be no greater than 275 g/L in accord with SCAQMD Rule 1113.

3.4 FINISH APPLICATION

- A. Apply in accordance with manufacturer's recommendations.
- B. Provide adequate ventilation during and after application until coating is dry.
- C. Two coats are required.
- D. Apply FC 166 by airless spray to yield a uniform finish.
- E. Allow surface to dry a minimum of 16 hours, or until hard.
- F. Apply second coat as above.
- G. Allow surface to dry a minimum of 48 hours before applying Over Coat FC 167.

3.5 PROTECTION AND CLEANUP

- A. Protect work against damage by adjacent construction activity.
- B. Remove temporary protective wrappings, after completion of operations.
- C. Use care not to damage finished surfaces.
- D. Clean, repair or replace damaged work as directed by Architect.
- E. Remove surplus materials, scaffolding and debris.
- F. Leave areas broom clean.

END OF SECTION

SECTION 07 14 13
RUBBERIZED ASPHALT MEMBRANE WATERPROOFING (RAM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Rubberized Asphalt Membrane Waterproofing (RAM), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Apply RAM Waterproofing to:
 - 1. Top side surfaces of subgrade roof decks covering spaces located outside of the footprint of the building above.
 - 2. Top side surfaces of elevated exterior terrace decks.
 - 3. Planters.
 - 4. Exterior side of exterior walls below grade.
 - 5. Exterior side of walls surrounding elevator pits and areas having lowered floor slabs.
 - 6. Other areas indicated.
- B. Minimum Physical Properties:

Minimum Physical Properties		
Property	Test Method	Minimum Result
Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Water Vapor Permeability	ASTM-E96, Procedure E, CGSB-37.50-M89	0.018 Perm
Water Resistance (5 days/50 degC)	CGSB-37.50-M89	No delamination, blistering, emulsification, or deterioration
Water Absorption	CGSB-37.50-M89	0.22 g weight gain
Toughness	CGSB-37.50-M89	13.0 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	0.069
Viscosity	CGSB-37.50-M89	7.0 seconds
Heat Stability	CGSB-37.50-M89	No change in viscosity, penetration, flow or low temperature flexibility
Low Temperature Flexibility (- 25 degC)	CGSB-37.50-M89	No delamination, flexibility adhesion loss, or cracking
Penetration	ASTM-D5329, CGSB-37.50-M89	75.0mm at 77 degF 121.7mm at 122 degF
Flow	ASTM-D5329, GSB-37.50-M89	0.0mm at 140 degF
Softening Point	ASTM-D36	82 degC 180 degF
Elongation	ASTM-D5329	1000percent minimum
Resiliency	ASTM-D5329	40percent minimum
Bond to Concrete at 0 degF	ASTM-D5329	Pass
Acid Resistance	ASTM-D896 Procedure 7.1 (N-8)	Pass 50 percent Nitric Acid, 50 percent Sulfuric

Solids Content	--	Acid 100percent no solvents
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- C. Applicator Qualifications:
 - 1. Licensed or franchised by system manufacturer.
 - 2. Factory trained by system manufacturer.

1.3 SUBMITTALS

- A. Product Data.
- B. Letter from Manufacturer indicating acceptance of substrates (including additives placed into the concrete mix.
- C. Shop drawings
 - 1. Locations to be installed.
 - 2. Details of all horizontal and vertical applications.
 - 3. Details of horizontal to vertical conditions.
 - 4. Termination details.
 - 5. Transition details and flashing details.
 - 6. Manufacturer's recommended details at interface with other systems:
 - a. Air barrier system with silicone transition membrane.
 - b. Glazing systems.
 - c. Silicone sealants.
- D. Manufacturer's installation instructions
 - 1. Include information about incompatible sealants to be avoided.
- E. Project Information:
 - 1. Certification of installer qualifications.
 - 2. Water test report.
- F. Contract Closeout Information:
 - 1. Warranty.
- G. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 WARRANTY

- A. 215 mil Systems: Warrant waterproof integrity for a period of ten (10) years from date of substantial completion.
- B. Warranty signed jointly by waterproofer and manufacturer.
- C. Repair and replace waterproofing that fails during warranty period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. RAM Waterproofing System:
 - 1. Base:

- a. American Hydrotech.
- 2. Optional:
 - a. Carlisle Coatings and Waterproofing, Incorporated.
 - b. Tremco.
- B. Reglets:
 - 1. Base:
 - a. Dayton Superior Chemical Division.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Concrete Surface Conditioner:
 - 1. Products recommended by system manufacture for conditions to be encountered.
 - 2. Conform to ASTM-D41 and/or CGSB 9M.
- B. RAM Waterproof Membrane:
 - 1. Hot, fluid applied, reinforced rubberized asphalt membrane.
 - 2. Minimum thickness: 215 mil, fabric reinforced.
 - 3. Base Product: "MM6125-FR" by American Hydrotech.
 - 4. Fabric Reinforcement sheet:
 - a. Spunbond polyester reinforcing sheet.
 - b. Minimum Weight: 1.3 OZ/YD².
 - c. Base Product: Flex-Flash F by American Hydrotech.
- C. Flashing/Reinforcing:
 - 1. Uncured neoprene:
 - a. Thickness: 60 mil.
 - b. Base Product: Flex-Flash UN by American Hydrotech.
 - 2. Spunbond polyester fabric:
 - a. Minimum Weight: 1.3 OZ/YD².
 - b. Base Product: Flex-Flash F Vertical by American Hydrotech.
 - 3. Open-weave fiberglass sheet:
 - a. Base Product: Flex-Flash F by American Hydrotech.
 - 4. Torchable, modified asphalt sheet:
 - a. For exposed flashings.
 - b. Thickness: 15 mil.
 - c. Base Product: Flex-Flash MB by American Hydrotech.
- D. Separation Sheet Protection Course:
 - 1. Horizontal Applications:
 - a. Fiberglass reinforced, rubberized asphalt.
 - b. Thickness: 90 mils.
 - c. Base Product: "Hydroflex 30" by American Hydrotech.
 - d. Other manufactures must use a comparable material.
 - 2. Vertical Application:
 - a. Rigid board insulation – standard type:
 - 1) Styrofoam "Square Edge" by Dow.
 - 2) Compressive strength: Minimum 25 PSI.
 - 3) Thickness: 2 IN.
- E. Prefabricated Drainage Course – Horizontal applications:
 - 1. Pre-manufactured crush-proof geo-textile.
 - 2. Compressive Strength: 30,000 PSF.
 - 3. Thickness: 0.22 IN.
 - 4. Base Product: "Hydrodrain" by American Hydrotech.
- F. Rigid Board Insulation – Horizontal applications:
 - 1. Extruded Polystyrene (XPS):

- a. Comply with ASTM-C578, Type VI or VII.
- b. Minimum R-value: R5.0 per IN (ASTM-C518).
2. Minimum thickness:
 - a. 3 IN.
3. Minimum Compressive Strength per ASTM-D1621:
 - a. 40 PSI.
4. Install rigid board insulation board over waterproofing.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces to be waterproofed and verify construction as specified in Section 03 35 00.
- B. Clean substrate in accordance with manufacturer's specifications.
- C. Do not proceed until nonconforming conditions have been corrected.
- D. Beginning of installation constitutes acceptance of substrate.

3.2 INSTALLATION

- A. Install waterproofing to manufacturer's specifications.
- B. Repair surface defects on substrate.
- C. Fill and patch voids.
- D. Prepare and install detail areas first including penetrations, terminations, intersections, and transitions.
 1. Coordinate detailing with subcontractors responsible for penetrations made after waterproofing system is complete.
 2. Grout all penetrations solid.
 3. Provide manufacturer's warranted details at terminations including, but not necessarily limited to, joints with other waterproofing systems.
- E. At elevated terrace decks:
 1. Provide integral sheet flashing glazed into the curtainwall sill.
 2. Provide continuous installation at terrace deck and vertical faces of curbs.

3.3 PROTECTION

- A. Take care to protect installed membrane from damage.
- B. Assure that reinforcing chairs, for concrete to be placed on membrane, have plastic tips or spacers to preclude damage to membrane.

3.4 WATER TEST

- A. Dam area to be tested and pond minimum 2 IN of water for 48 hours.
- B. Replace failed installations.
- C. Retest and repair until satisfactory.
- D. Refer to Section 01 91 13.

3.5 REPAIR AND CLEANING

- A. Repair areas which fail, or do not comply with specifications.
- B. Leave surfaces broom clean.
- C. Remove debris resulting from these operations.

END OF SECTION

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SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Building Insulation, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with the following reference standards:
 - 1. Underwriters Laboratories Inc.
 - 2. ASTM-C518. Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. ASTM-C739. Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.
 - 4. ASTM-E84. Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 5. ASTM-E90. Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 6. ASTM-E119. Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 7. ASTM-E136. Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
- B. Insulation value exterior walls: R-19.
- C. Field Testing: Refer to Section 01 91 13 for testing requirements.

1.3 SUBMITTALS

- A. Project Information:
 - 1. Manufacturer of listed products.
- B. Product Data.
- C. Manufacturer's installation instructions.
 - 1. Including substrate compatibility requirements.
 - 2. Substrate compliance requirements.
 - 3. Attachment method.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2: Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Adhesives: Manufacturers' product data for construction adhesive including VOC content.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Rigid Board Insulation Extruded Polystyrene (XPS):
 - 1. Base:
 - a. Dow Chemical (Styrofoam).
 - 2. Optional:
 - a. Pactiv Building Products (GreenGuard).
 - b. Owens-Corning (Foamular).
- B. Other Materials:
 - 1. Base:
 - a. As indicated.
- C. Other manufacturers desiring approval, comply with Section 00 26 00.

2.2 MATERIALS

- A. Rigid Board Insulation - Extruded Polystyrene (XPS):
 - 1. Foamed, extruded polystyrene complying with ASTM-C575.
 - 2. Minimum Compressive Strength:
 - a. 25 PSI at vertical applications.
 - b. 40 PSI at horizontal, top side surface applications.
 - 3. Minimum Surface Burning Characteristics (per ASTM-E84):
 - a. Flame Spread: less than 75.
 - b. Smoke Developed: less than 450.
 - 4. Water vapor permance for 1 IN product: 1.00 perm, maximum.
 - 5. Water absorption: Maximum 0.15 percent.
 - 6. Thermal resistance: R-value of 5.0 per inch at 75 degF mean temperature.
 - 7. Integral high density skin.
 - 8. Minimum thickness:
 - a. 3 IN.
 - b. Other thicknesses as indicated or required.
 - 9. Mechanical fasteners for attachment of polystyrene insulation: As recommended by insulation manufacturer.
- B. Mineral Fiber Spandrel Insulation:
 - 1. Mineral wool fibers and resinous binders formed into batts with aluminum foil scrim/vapor retarder.
 - 2. Nominal Density: 4 PCF.
 - 3. Minimum Thermal Value: R4 per IN.
 - 4. Thickness:
 - a. 3 IN.
 - b. Note: Use a lesser thickness, where required, to maintain 1 IN clearance between back of glass unit and face of spandrel insulation.
 - 5. Flame spread not to exceed 25 when tested in accord with ASTM-E84.
 - 6. Smoke developed not to exceed 50 when tested in accord with ASTM-E84.
 - 7. Base Product:
 - a. FSP Curtainwall insulation, Thermafiber.
 - 8. Mechanical fasteners; impaling clips/pins:
 - a. Pronged hangers and slotted washers or arrow pointed hangers.
 - b. Sized to fit insulation thickness.
 - c. Base Product: GEMCO as manufactured by Goodloe E. Moore.
 - 1) Gemco pronged hanger with WP washer.
 - d. Optional: Stic-Klip Manufacturing.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Insulate full thickness over surfaces to be insulated.
- B. Fit tightly around obstructions, fill voids with SPF Insulation (See Section 07 21 31).
- C. Cover penetrations with SPF insulation (See Section 07 21 31).
- D. Seal joints with sealant and tape.
- E. Seal or tape to abutting materials to maintain continuous thermal resistance and to prevent air movement behind insulation.
- F. Install air/vapor retarder on in-board side of insulation.
- G. Comply with manufacturer's instructions for installation unless more stringent requirements are specified.
- H. If manufacturer's instructions are not available, or not applicable, consult manufacturer's technical representative for specific recommendations prior to installation.
- I. Apply rigid insulation in double layer with staggered joints to achieve total thickness.
- J. Butt boards tightly.
- K. Do not use broken or torn pieces of insulation.
- L. Install so completed installation provides a continuous thermal plane and prevents air movement behind the insulation.
- M. Repair areas as required to insure air tight integrity.
- N. Do not allow foam type insulation to remain exposed to inside of building.
- O. Provide minimum cover of 1/2 IN gypsum wallboard over exposed foam surfaces.

3.3 INSTALLATION – RIGID BOARD INSULATION (XPS) IN RAIN SCREEN OR CAVITY WALL CONSTRUCTION

- A. Coordinate installation with work of other trades.
- B. Verify vapor retarder and moisture barrier installation is complete.
- C. Comply with manufacturer's directions for particular conditions of installation.
- D. Secure insulation by use of mechanical fasteners; impaling clips and pins.
 - 1. Locate fasteners 6 IN from edges and at 12 IN OC each direction.
 - 2. Lay out work before installing mechanical fasteners.
 - 3. Lay out fasteners and install in mastic.
 - 4. Allow mastic to set.
 - 5. Test to ensure fasteners are secure.
 - 6. Install washers and bend prongs of fasteners.
- E. Extend insulation full thickness over entire surface to be installed.
- F. Cut and fill tightly around penetrating elements and abutting construction.
- G. Install insulation with tight joints, without voids, pressing onto mechanical fasteners.
- H. Seal joints with sealant and tape.

- I. Do not install insulation over or within 3 IN of recessed lighting fixtures, ballasts, wiring compartments, fans, or other heat-generating devices unless fixtures are protected.

3.4 INSTALLATION - RIGID BOARD INSULATION (XPS) AT FOUNDATIONS

- A. General:
 1. Install XPS insulation at foundation at building perimeter.
 2. Install both vertically (and horizontally as required) at foundation.
 3. Minimum Thickness (unless otherwise indicated): 3 IN.
- B. Foundation Insulation, vertical:
 1. Install insulation underground outside foundation walls.
 2. Extend down for distance indicated in one layer
 - a. If not indicated, extend down to design frost line.
 3. Install in mastic with tight joints on walls.
 4. Protect from damage and/or displacement during backfilling.
 5. Do not apply to exterior portions of foundation that will be exposed to view.
 6. Refer also to requirements of Section 07 14 13 Rubberized Asphalt Membrane Waterproofing (RAM).
- C. Foundation Insulation, horizontal:
 1. Refer to requirements of Section 07 14 13 Rubberized Asphalt Membrane Waterproofing (RAM).

3.5 INSTALLATION – MINERAL FIBER SPANDREL INSULATION

- A. General:
 1. Install tightly fit boards between window framing members.
 2. Leave a minimum of 1 IN air space between glass and insulation.
 3. Where installed at floor line: Construct per UL-approved methods.
- B. Secure insulation by use of mechanical fasteners; impaling clips/pins.
 1. Install metal clips on framing members.
 2. Locate fasteners 6 IN from edges and at 12 IN OC each direction.
 3. Install mineral fiber insulation with tight joints, without voids, pressing onto fasteners.
 - a. FSK facing to be installed facing to inside of building.
 4. Install washers and clip prongs of fasteners.
 5. Patch with vapor retarder tape.
- C. Tape edges of vapor retarder to window frame to form continuous vapor retarder.
 1. Tape butt edges of insulation to each other.
- D. Tape seams, washers, and all penetrations and edge terminations.
 1. Cover fastener with 6 IN square of vapor retarder tape.
 2. Cover penetrations or connections which remain exposed after insulation is in place and sealed, with minimum 1 IN thick insulation.
 3. Cover penetrations for a minimum of 6 IN on each side.

END OF SECTION

SECTION 07 21 31
SPRAYED POLYURETHANE FOAM (SPF) INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Sprayed Polyurethane Foam (SPF) Insulation, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Final assembly must meet building code requirements.
- B. Installation by approved manufacturer.

1.3 SUBMITTALS

- A. Project Information:
 - 1. Manufacturer of listed products.
- B. Product Information.
- C. Shop Drawings.
- D. Manufacturer's installation instructions.
 - 1. Hot and cold weather procedures.
 - 2. Substrate requirements.
- E. LEED Information:
 - 1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- 1. SPF Insulation System:
 - a. Base:
 - 1) BASF Corp., Polyurethane Foam Enterprises, LLC.
 - b. Optional:
 - 1) Corbond Corporation.
 - 2) Dow Chemical Company.
 - 3) Henry Company.
- 2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Sprayed Polyurethane Foam (SPF) Insulation:
 - 1. Closed-Cell Polyurethane Foam Insulation: ASTM-C1029, Type II.
 - 2. 2 or 3 component polyurethane-based, spray applied.
 - 3. Density: 2.15 LBS/FT³ at 2 IN lift.
 - 4. Compressive strength: 15 PSI.

5. Closed cell content: 90%.
6. Thermal Resistance, aged: R per IN at 75 degF.
7. Permeance: 2.5 Perm per IN.
8. Fire Resistance Ratings per ASTM-E84, 2 IN-thick sample:
 - a. Flame Spread: Less than 75.
 - b. Smoke Developed: Less than 450.
9. Base Product: Spraytite 158 Series by BASF.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify acceptability of substrate.
- B. If required, clean or treat substrate for adhesion.

3.2 INSTALLATION - GENERAL

- A. Comply with manufacturer's written instructions applicable to products and applications indicated.
- B. Extend insulation to envelop entire area to be insulated.
 1. Fill tightly around obstructions and voids.
 2. Install insulation tight to substrate.
 3. Remove projections that interfere with placement.

3.3 INSTALLATION - FOAM INSULATION

- A. Apply with manufacturer's approved spray equipment.
- B. Apply to a thickness of 3 IN.
 1. Final thickness of foam insulation must be within minus 1/16 IN, plus 1/2 IN of required thickness.
 2. Minimum performance of installed thickness:
 - a. Minimum installed Thermal Resistance: R-value =18.
 - b. Minimum installed Permeance: 0.8 Perm.
 3. Fill all miscellaneous voids completely to eliminate dead air spaces.
 4. Perform one thickness test per 100 FT².

3.4 CLEANING

- A. Remove overspray from installed materials which are not scheduled for application.
- B. Protect installed materials from damage due to harmful weather exposures, physical abuse, and other causes.
- C. Repair damaged areas.

END OF SECTION

SECTION 07 27 26
FLUID-APPLIED AIR BARRIER - VAPOR RESISTIVE

PART 1 - GENERAL

1.1 SUMMARY

- A. Materials and installation methods for fluid applied, vapor resistive air barrier membrane system located in non-accessible part of wall.
- B. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through wall assembly.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM-C920 Specifications for Elastomeric Joint Sealants.
 - 2. ASTM-C1193 Guide for Use of Joint Sealants.
 - 3. ASTM-C836, Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
 - 4. ASTM-D412, Standard Test Methods for Rubber Properties in Tension.
 - 5. ASTM-D903, Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - 6. ASTM-D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 7. ASTM-D3767, Standard Practice for Rubber - Measurements of Dimensions.
 - 8. ASTM-E96, Test Methods for Water Vapor Transmission of Materials.
 - 9. ASTM-E2178, Standard Test Method for Air Permeance of Building Materials.
 - 10. ASTM-E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across Specimen.
 - 11. ASTM-E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
 - 12. Field Test Standards:
 - a. Refer to Section 01 91 13 for testing requirements.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Air and vapor barrier systems shall be manufactured by firm with minimum of 20 years of experience in production of waterproofing.
- B. Applicator: Experienced in application of air barrier materials similar in material, design complexity, and extent to those indicated for this Project, with a record of timely and successful in-service performance.
- C. Material Performance Requirements: Air and vapor barrier membrane and auxiliary materials shall be tested to comply as follows:
 - 1. Air Permeance: Not greater than 0.004 cfm/sf under pressure differential of 1.57 psf, as tested in accordance with ASTM-E2178.
 - 2. Vapor Permeance: Not greater than 0.1 Perm when tested in accordance with ASTM-E96.
- D. Assembly Performance: Continuous air and vapor barrier assembly shall provide the following property as demonstrated by laboratory testing:
 - 1. Air Permeance: Not greater than 0.040 cfm/sf under pressure differential of 1.57 psf, as tested in accordance with ASTM-E2357.

- E. Air barrier shall be joined in an airtight and flexible manner to air barrier material of adjacent systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
 - 1. Foundation and walls.
 - 2. Walls and windows or doors.
 - 3. Different wall systems.
 - 4. Wall and roof.
 - 5. Wall and roof over unconditioned space.
 - 6. Walls, floors and roof across construction, control and expansion joints.
 - 7. Walls, floors and roof to utility, pipe and duct penetrations.
- F. Field Testing: Refer to Section 01 91 13 for testing requirements.

1.4 PRE-INSTALLATION MEETING

- A. Conduct pre-installation meeting prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation meeting shall include Contractor, installer and system manufacturer's field representative. Agenda for meeting shall include but not be limited to following:
 - 1. Review submittals.
 - 2. Review surface preparation, minimum curing period and installation procedures.
 - 3. Review special details and flashings.
 - 4. Sequence of construction, responsibilities and schedule for subsequent operations.
 - 5. Review mock-up requirements.
 - 6. Review inspection, testing, protection and repair procedures.

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
- B. Product Data.
 - 1. Including all components of the system.
- C. Project Information:
 - 1. Written documentation demonstrating applicator's qualifications.
 - 2. Minutes of Pre-installation meeting.
- D. Manufacturer's installation instructions.
- E. Manufacturer's instructions for protection of the air barrier system after installation.
- F. Sample Warranty.
- G. Mock-up and Field Test:
 - 1. See Quality Assurance for description and test requirements.
 - 2. Coordinate with Laboratory's inspection and testing agency.
 - 3. Do not cover installed work before inspection, testing and approval.
 - 4. Mock-up may be part of the work.
 - 5. Refer to Section 01 91 13 for testing requirements.
- H. Contract Closeout Information:
 - 1. Manufacturer's Warranty.
 - 2. Applicator's Warranty.
- I. LEED Information:

1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data indicating VOC content of adhesive or sealants.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets.

1.7 WARRANTY

- A. Standard Product Warranty:
 1. Submit manufacturer's warranty that air and vapor barrier and accessories are free of defects at time of delivery, and are manufactured to meet manufacturer's published physical properties and material specifications.
 2. Installer to warrant that air and vapor barrier and accessories have been installed in accord with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable Manufacturers:
 1. Fluid-applied Air and Vapor Barrier System:
 - a. Base:
 - 1) Tremco.
 - b. Optional:
 - 1) Grace Construction Products.
 2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 SYSTEM COMPONENTS

- A. Provide primary materials of one manufacturer for each component required for work.
- B. Base Products:
 1. Fluid Applied Membrane: Tremco ExoAir 120, fluid applied air and vapor barrier.
 2. Transition Mastic: ExoAir Termination Mastic.
 3. Transition Assembly: Tremco Proglaze ETA Connections.
 - a. Ribbed silicone sheet extrusion.
 - b. Silicone rubber corners.
 - c. Extruded aluminum adaptor.
 - d. Tremco 440 Tape.
 - e. Spectrem 1 silicone sealant.
 - f. Other accessory products required for a complete installation.
 4. Flexible Membrane wall flashing: ExoAir TWF
 5. Primer: ExoAir Primer.
- C. Sealants applied inside the building envelope shall have a VOC content no greater than 250 g/L

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer for compliance with requirements and other conditions affecting performance as prescribed by system manufacturer. Notify contractor in writing of circumstances detrimental to proper completion of work.
 - 1. Examination shall include review of sheathing fastener type and spacing.

3.2 PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates.
 - 1. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.
 - 2. Remove deleterious contaminants from exposed surfaces.
 - 3. Use repair materials and methods that are acceptable to manufacturer.
 - 4. Verify that sheathing has been fastened according to manufacturer's recommendations with appropriate screws and fastener spacing.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive air and vapor barrier membrane.

3.3 INSTALLATION

- A. Refer to manufacturer's literature for directions for installation.
- B. Perform work only when existing and forecast weather conditions are within limits established by manufacturer.
- C. Exterior sheathing panels:
 - 1. Pre-treat joints with reinforced self-adhesive tape.
 - 2. Caulk gaps greater than 1/4 IN. Allow caulk to fully cure (according to caulk manufacturer's recommendations) prior to applying air barrier.
- D. Masonry Substrates:
 - 1. Apply air and vapor barrier over cmu and brick with smooth trowel-cut mortar joints.
 - 2. Fill voids, holes and mortar joints, with lean mortar mix, non-shrinking grout or parge coat.
- E. Fluid Applied Membrane:
 - 1. Membrane shall be applied 60 mils in thickness minimum but not less than the manufacturer's recommended thickness.
 - 2. Membrane shall be applied uniformly and continuously.
 - 3. Spray or roller apply continuous uniform film using multiple, overlapping passes to ensure even thickness and coverage.
 - 4. Seal penetrations as work progresses.
- F. Transition Membrane:
 - 1. Install mastic at terminations, substrate transitions, penetrations and overlaps according to manufacturer's standard details.
 - 2. Transition membrane shall be installed when fluid applied membrane is tack-free.
 - 3. All seams shall be rolled with a hand roller.
 - 4. Overlap fluid applied membrane onto each surface 3 IN minimum at beams, columns and joints.
 - 5. Tie in to roof and floor intersections and changes in substrate.
 - 6. Seal top edge of flashing with termination mastic.
- G. Transition at Fenestration Systems:
 - 1. Provide engineered silicone transition assembly (ETA) connection at perimeters of curtain wall systems, entrance systems, door frames, and louvers to tie into air barrier.
 - 2. Install according to manufacturer's instructions.

3. Provide system type most appropriate for each condition as recommended by manufacturer.
- H. Flexible Membrane Through Wall Flashing:
1. Fully adhere flashing to substrate.
 2. Overlap adjacent pieces and roll seams 2 IN minimum.
 3. Trim bottom edge 1 IN back from exposed face of wall.
 4. Provide stainless steel end dam flashing at opening heads, sills, and flashing terminations.
Refer to Section 07 62 00.
 5. Seal top edge of flashing with termination mastic.

3.4 FIELD QUALITY CONTROL

- A. Mock-up:
1. Construct typical exterior wall section, incorporating back-up wall, cladding, window, door frame and sill, insulation, flashing and other critical junctions.
 2. Allow adequate time to inspect and test mock-up before proceeding with work.
 3. Mock-up shall be tested per requirements of Section 01 91 13.
 4. Mock-up may be part of the work.

3.5 PROTECTION AND CLEANING

- A. Schedule work to ensure that system is covered as soon as practicable.
1. Protect system from damage during subsequent operations.
- B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Apply temporary UV protection if system cannot be covered within 45 days after installation. Remove and replace air barrier exposed for more than 60 days.
- C. Further, protect air barrier until fully cured. Protect top of wall and do not allow water to enter the wall until air barrier is fully cured.
- D. Clean spills, stains, and soiling from construction that would be exposed in completed work as recommended by manufacturer of affected construction.
- E. Remove masking materials after installation.

END OF SECTION

Argonne National Laboratory Energy Sciences Building 241
ANL Document No. J241-101-W-T015 Issued for Proposal - 3/7/11
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Issued for Construction - 6/30/11

SECTION 07 42 16

PREFORMED EXPOSED FASTENER METAL PANELS (Revised AD-1)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Preformed Metal Panels, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer qualifications: Manufacturer or installer franchised or approved in writing by manufacturer.
- B. Provide engineering design performed and sealed by registered Structural Engineer (SE), licensed in the State of Illinois.

AD-1:

- C. Design Criteria for Wall Panels and Louvers:
 - 1. Design wall systems and anchorage to meet Design Load.
 - a. Wind Loads – Use the greater of the following:
 - 1) Wind Pressures listed on Design Requirements on Structural Drawings.
 - 2) Wind Pressures defined by Building Code as locally adopted and amended.
 - 3) 20 PSF Minimum.
 - 2. Deflection:
 - a. Not exceeding L/180 at 30 PSF wind load.
 - b. Test according to ASTM-E72.
 - 3. Thermal Movement:
 - a. Allow for thermal movement from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.
 - 4. Field Testing: Refer to Section 01 91 13 for testing requirements.
- D. Performance Criteria for Roof Panels:
 - 1. Design roof systems and anchorage to meet Design Loads.
 - a. Wind Loads – Use the greater of the following:
 - 1) Wind Pressures listed on Design Requirements on Structural Drawings.
 - 2) Wind Pressures defined by Building Code as locally adopted and amended.
 - 3) 25 PSF Minimum.
 - b. Roof loads – Use the greater of the following:
 - 1) Snow loads listed on Design Requirements on Structural Drawings.
 - 2) Snow loads defined by Building Code as locally adopted and amended, including drifting.
 - 3) 30 PSF Minimum.
 - 2. Static Water Infiltration:
 - a. No uncontrollable water leakage at a pressure differential of 6.24 PSF when tested in accordance with ASTM E1646-95.

AD-1:

1.3 PRE-INSTALLATION MEETING

- A. Contractor:

- B. Prior to beginning of operations, schedule pre-installation meeting. Pre-installation meeting will serve to clarify specifications, details and related. Include following:
 - a. Contractor.
 - b. Siding installer superintendent.
 - c. Siding manufacturer representative.
 - d. Sheet metal installer performing metal flashing work.
 - e. Carpentry installer.
 - f. Anyone else involved in or performing work effecting siding system.
- C. Minimum 2 weeks prior to meeting, forward pertinent information to Contractor for review.
 - 1. Installation drawings.
 - 2. Manufacturer product data.
 - 3. Samples of proposed materials.
 - 4. Sample warranty.
 - 5. Other pertinent information.
- D. Meeting agenda to include, but not be limited to, following items for discussion:
 - 1. Contract Document requirements.
 - 2. Plans and elevations.
 - 3. Wall and flashing details.
 - 4. Siding manufacturer specifications and details.
 - 5. Siding installer recommendations.
 - 6. Review of shop drawings.
 - 7. Available on site storage.
 - 8. Protection from damage by other trades.
- E. Pre-installation meeting will serve to clarify specifications, details, application requirements and what work should be completed prior to beginning of siding operation.

1.4 SUBMITTALS

- A. Shop drawings for wall panels.
 - 1. Include full elevations showing openings and penetrations.
 - 2. Include details of each condition of installation and attachment.
 - 3. Include details at a minimum scale of 1 1/2" = 1'-0" of all required trim and extrusions needed for a complete installation.
 - 4. Indicate points of supporting structure that must coordinate with metal wall panel assembly installation.
 - 5. Method for separation of dissimilar metals.
- B. Shop drawings for roof panels.
 - 1. Complete layout indicating types of roofing, anchorage, supplementary framing, separation of dissimilar metals, cut openings, accessories, and flashing conditions.

AD-1:

- 2. Layout and attachment details for snow guard system.

C. Samples:

- 1. 12 x 12 IN of each panel type.

AD-1:

- 2. Snow guard.
- 3. For color selection.
 - a. 3 IN x 5 IN minimum samples of three (3) colors identified by Architect for each panel type.

D. Project Information for wall panels:

- 1. Certification of installer qualifications.

E. Project Information for roof panels:

- 1. Certification of conformance with wind uplift standard listed.

- F. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Warranty.
- G. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.5 WARRANTY – WALL PANELS

- A. General Warranty:
 - 1. Provide five (5) year warranty, on wall panels, flashing and associated work.
 - 2. Warranty to cover waterproof integrity of panel system against leaks through wall.
 - 3. Warranty signed by Contractor and Installer.
- B. PVDF Finish:
 - 1. Provide twenty (20) year warranty.

1.6 WARRANTY – ROOF PANELS

- A. General Warranty:
 - 1. Provide five (5) year warranty, signed jointly by roofing materials manufacturer and installer.
 - 2. Warrant watertightness of roof and associated flashing.
- B. PVDF Finish:
 - 1. Provide twenty (20) year warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Preformed Metal Siding and Roofing Panels:
 - 1. Base:
 - a. Centria.
 - 2. Optional:
 - a. Fabral.
 - b. Firestone Una-Clad.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS – PREFORMED METAL SIDING

AD-1:

- A. Preformed Metal Siding Type #1:
 - 1. Zinc-coated (Galvanized) Steel Face Sheet: Smooth surface, ASTM A 653/A 653M, G90 (Class Z275), Structural steel quality.
 - 2. Face sheet: 22 GA minimum thickness (nominal uncoated).
 - 3. Design:
 - a. Nominal 36 IN wide.
 - b. Panel depth: 3 IN.
 - c. Rib spacing: 12 IN.
 - d. Exposed fastener panels.

- e. Base: Centria Profile Series MR3-36.
- 4. Exterior finish:
 - a. Minimum 70 percent Kynar 500.
 - b. Color as selected by Architect.
 - 1) Base: Color from Centria Sundance Series Colors.
 - 2) Color most closely resembling a clear anodized finish color.

AD-1:

- B. Preformed Metal Siding Type #2
 - 1. Zinc-coated (Galvanized) Steel Face Sheet: Smooth surface, ASTM A 653/A 653M, G90 (Class Z275), Structural steel quality.
 - 2. Face sheet: 22 GA minimum thickness.
 - 3. Design:
 - a. Nominal 36 IN wide.
 - b. Panel depth: 1 ½ IN.
 - c. Rib spacing: 7.2 IN.
 - d. Exposed fastener panels.
 - e. Base: Centria Profile Series BR5-36.
 - 4. Exterior finish:
 - a. Minimum 70 percent Kynar 500.
 - b. Color as selected by Architect.
 - 1) Base: Color from Centria Sundance Series Colors.
 - 2) Color most closely resembling a clear anodized finish color.

AD-1:

- C. Preformed Metal Siding Type #3
 - 1. Zinc-coated (Galvanized Steel Face Sheet: Smooth surface, ASTM A 653/A 653M, G90 (Class Z275), Structural steel quality.
 - 2. Face sheet: 22 GA minimum thickness.
 - 3. Design:
 - a. Nominal 37 IN wide.
 - b. Panel depth: ½ IN.
 - c. Rib spacing: 2-2/3 IN.
 - d. Exposed fastener panels.
 - e. Base: Centria Profile Series Econolap ½”.
 - 4. Exterior Finish:
 - a. Minimum 70 percent Kynar 500.
 - b. Color as selected by Architect.
 - 1) Base: Color from Centria Sundance Series Colors.
 - 2) Color most closely resembling a clear anodized finish color.
- D. Perimeter trim pieces, flashing, copings, and accessories:
 - 1. As required to complete entire wall panel installation.
 - 2. Shop fabricated corners.
 - 3. Match color and finish of wall panels.
- E. Fastening system: Nonferrous.
- F. Subgirts and supports:
 - 1. G60 galvanized subgirts and intermediate support items as required for installation.
- G. Pressure seal tape – to maintain seal against air/water infiltration at fastener penetrations of air barrier and sheathing.
- H. Insulation:
 - 1. Material: Extruded polystyrene insulation.
 - 2. Minimum 3 IN.

AD-1:

- I. Louvers
 1. All components Zinc-coated (Galvanized) steel.
 2. 18 GA minimum blades.
 3. Drainable blades.
 4. Profile of louver blades shall match profile of adjacent preformed exposed fastener metal siding - Type #1.
 5. Concealed vertical supports.
 6. Minimum Free Area: 39%.
 7. Minimum Blade Depth: 6 IN.
 8. Bird screen: 16 GA aluminum, ½ IN square mesh, captured in folded frame.
 9. Base: Centria Profile Series MR3-36 Horizontal Profile Louver.
 10. Louver Finish:
 - a. Minimum 70 percent Kynar 500.
 - b. Color as selected by Architect.
 - 1) Base: Color from Centria Sundance Series Colors.
 - 2) Color most closely resembling a clear anodized finish color.
 11. Gang louver units together, where necessary or where indicated to makeup the overall sizes required.
 12. Sealant: See section 07 92 13 for materials.
 13. Accessories: Fabricate anchors, reinforcing, and required ancillary items of compatible material.

2.3 MATERIALS – PREFORMED METAL ROOFING

- A. Preformed metal roofing
 1. General:
 - a. Factory-formed, pre-finished, metal roofing system with exposed fasteners and interconnecting side joints, fastened to supports with exposed fasteners, with field-applied sealants in side laps.
 - b. Include perimeter trim items to match.
 - c. Fabricate and install to withstand structural and thermal movement, wind loading, and weather exposure without defects.

AD-1:

AD-1:

2. Material Standards:
 - a. Zinc-coated (Galvanized Steel Face Sheet: Smooth surface, ASTM A 653/A 653M, G90 (Class Z275), Structural steel quality.
 - b. Face sheet: 22 GA minimum thickness.
3. Design:
 - a. Panel coverage: Nominal 36 IN wide.
 - b. Panel depth: 3 IN.
 - c. Rib spacing: 12 IN.
 - d. Installed wide cell down.
 - e. Finished both sides.
 - f. Exposed fastener panels.
 - g. Base: Centria MR3--36
4. Exterior (top side) finish:
 - a. Minimum 70 percent Kynar 500.
 - b. Color as selected by Architect.
 - 1) Base: Color from Centria Sundance Series and Prismatic Series Colors.
5. Interior (bottom side) finish:
 - a. Minimum 70 percent Kynar 500.
 - b. Color: White.

- B. Metal roof panel accessories

1. Provide complete metal roof panel assembly incorporating trim, fascia, gutters, downspouts, closures and miscellaneous flashings. Provide required fasteners, gaskets, closure strips, and sealants. Fabricate and install accessories in accordance with SMACNA manual.
 - a. Aluminum roof panel systems: Comply with ASTM E 1637 and AA "Specification for Aluminum Structures."
 - b. Flashing and trim: Match material, thickness, and finish of metal roof panels.
 - c. Panel fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by roof panel manufacturer. Provide corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating.
 - 1) Exposed screws: Manufacturer's recommended stainless steel screws with bonded neoprene and stainless steel washers, coated to match panel color.
 - 2) Concealed screws: Manufacturer's recommended corrosion-resistant carbon steel with corrosion-resistant coating.
 - d. Panel sealants:
 - 1) Field-applied unexposed sealant: Side laps, end laps, and flashing details: Gun grade, non-skinning, butyl elastomer or polymeric non-skinning butyl tape.
 - 2) Exposed sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight. As recommended by metal roof manufacturer. Colored to match panel color.
 - e. Closures:
 - 1) Metal: Matching metal roof panel material, thickness, and finish, precut to match panel profile.
 - 2) Closure at end condition to close gap below higher loading dock canopy fascia.
 - 3) Foam: Precut to match panel profile.

AD-1:

- C. Snow Guards
 1. Galvalume gusseted snow guards attached directly to roof deck.
 2. Provide appropriate snow guard and fasteners compatible with roof system.
 3. Fastener strength shall exceed that of the snow guard system.
 4. Set each snow guard in a bed of sealant prior to fastening.
 5. Base: Alpine Snowguards, #30 Snow Guard System or equal.
 6. Finish:
 - a. Minimum 70 percent Kynar 500.
 - b. Color to match color of roof panel.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to receive installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Erect panel system plumb, level, and square, within tolerances and industry standards. Installation tolerances must remain within panel manufacturing tolerances and thermal movement tolerances and requirements.
- B. Erect system, per reviewed shop drawings.
- C. Provide pressure seal tape to maintain air-tight seal where furring fasteners will penetrate the air barrier and sheathing.
- D. Use fasteners which lock entire unit to structural supports and prohibit negative load pulloff under design loads.

SECTION 07 42 43
ALUMINUM COMPOSITE MATERIAL (ACM) SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Aluminum Composite Material (ACM) System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM Standards:
 - 1. ASTM-E84.
 - 2. ASTM-C297.
 - 3. ASTM-D2794.
 - 4. ASTM-D1308.
- B. Aluminum Association Standards:
 - 1. AA-C22-A41.
 - 2. AA-C22-A44.
- C. American Society of Civil Engineers:
 - 1. ASCE-7, current edition.
- D. National Coil Coaters Association (NCCA):
 - 1. NCCA II-6.
 - 2. NCCA II-12.
 - 3. NCCA II-16.
- E. Fabricator Qualifications:
 - 1. Five years experience in cladding fabrication.
- F. Installer Qualifications:
 - 1. Franchised or certified by cladding manufacturer.
- G. Design wall systems and anchorage to meet Design Loads.
 - 1. Wind Loads – Use the greater of the following:
 - a. Wind Pressures listed on Design Requirements on Structural Drawings.
 - b. Wind Pressures defined by Building Code as locally adopted and amended.
 - c. 20 PSF Minimum.
- H. Field Testing: Refer to Section 01 91 13 for testing requirements.

1.3 SUBMITTALS

- A. Product Data.
- B. Shop Drawings:
 - 1. Installation details.
- C. Samples:
 - 1. Three 4 x 6 IN samples of panel in finish selected by Architect.
- D. Contract Closeout Information:
 - 1. Warranty.
 - 2. Maintenance data.
- E. LEED Information:

1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 WARRANTY

- A. Manufacturer's twenty (20) year warranty against failure of PVDF finish.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Aluminum Composite Material (ACM):
 1. Base:
 - a. Alcan Composites USA, Inc. (Alucobond).
 2. Optional:
 - a. Alply; Tech Wall.
 - b. Alcoa-Reynolds Metals.
 - c. Mitsubishi.
- B. Fabricator of Panels:
 1. Base:
 - a. Universe Corp.
 2. Optional:
 - a. Alply; Tech Wall.
 - b. Other Fabricators approved by listed Manufacturers.
- C. Installers:
 1. As approved by listed Manufacturers.

2.2 MATERIALS

- A. Aluminum Composite Material (ACM) System:
 1. Fabricate panels from two sheets of aluminum, permanently bonded to thermoplastic core.
 2. Form in continuous process to dimensions indicated with no glues or adhesives between dissimilar materials.
 3. Aluminum face sheets: Alloy compatible with finish.
 4. Face sheet thickness: 0.50mm.
 5. Alloy, temper and mill finish as recommended by panel manufacturer for strength, forming, welding and application of finish indicated, but no less than strength and durability properties specified in ASTM-B209.
 6. Minimum Thickness of Composite Panel sheet-goods:
 - a. 0.158 IN.
 7. Finish:
 - a. Anodic Coating:
 - 1) Class 1 clear anodized.
- B. Joints (pressure-equalized rainscreen):
 1. Dry joint system.
 2. Continuous perimeter extrusion.
 3. Pre-finished spline glazed into adjacent curtainwall jambs.

- C. Structural Criteria:
1. Design panel system to handle wind pressures, snow pressures, ice loads and seismic design forces as required by Building Code as locally adopted.
 - a. Panel Deflection (normal): Not more 0.01 times the least panel dimension, at full design pressure(s) and load(s).
 - b. Panel Deflection (ultimate): No disengagement, failure or gross permanent distortion of any component at 1.5 times design load(s).
 - c. Maximum Deflection of Framing Members supporting panels:
 - 1) At full design pressure: Not more than 1/175 for spans 13 FT or less and 1/240 + 0.25 IN for spans exceeding 13 FT.
 - d. At pressures less than design pressure: Not more than 1/360 or 1/8 IN whichever is less.
 2. Stiffen panels as required to handle the specified pressures and loads.
 - a. Where stiffeners are attached to panels with structural silicone:
 - 1) Minimum glue line thickness: 0.25 IN.
 - 2) Minimum sealant bond bite: Determined by calculation.
- D. Thermal Movement Criteria:
1. Design system and anchorage to provide fully for expansion and contraction caused by surface temperature ranging from -25 to 145 Deg F without causing buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance or other detrimental effects.
- E. Extrusions:
1. Aluminum alloy 6063-TS.
- F. Fasteners:
1. Non-magnetic stainless steel or other non-corrosive metal fasteners to be compatible with system components.
 2. Provide Phillips head screws unless otherwise indicated.
 3. Provide Allen socket head fasteners at removable panels.
 4. Fastening system to be non-ferrous concealed in finished work.
- G. Expansion joints:
1. Elastomeric, weather-resistant, flexible closure fabrication.
- H. Subgirts and Supports:
1. Aluminum subgirts and intermediate support items as required for installation.

2.3 FABRICATION

- A. General:
1. Fabricate panels to approximate dimensions and profiles indicated.
 - a. Adjust as required based on actual field dimensions.
 - b. Allow for thermal expansion/contraction between panels and structure.
 - c. Design panels to withstand structural loads indicated.
- B. Fabrication Tolerances:
1. Shop assemble panels to tolerances specified.
 2. Panel lines: Sharp, true and free from warp or buckle.
 3. Perform shop tests in manufacturer's factory to insure that panel dimensions, square-ness and bow are within specified tolerances.
 - a. Panel bow: 0.2 percent of panel dimension in width and length up to 1/8 IN maximum.
 - b. Width or length: Plus/minus 1/32 IN up to 48 IN and plus/minus 1/16 IN when greater than 48 IN.
 - c. Thickness: Plus/minus 0.02mm.
 - d. Square-ness: Not greater than 3/16 IN difference between diagonal measurements.
 - e. Camber: No greater than 1/32 IN.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to receive installation.
- B. Verify continuity of air barrier and insulation prior to installation.
 - 1. Air barrier system to be flashed into curtainwall jambs behind AMC system splines.
 - 2. Provide pressure seal tape to maintain air-tight seal where furring fasteners will penetrate the air barrier and sheathing.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 ERECTION

- A. Install support system, metal panels, fasteners, trim, sealant and related components in accordance with final erection drawings and approved shop drawings.
 - 1. Erect with concealed fasteners.
 - 2. Provide for necessary structural and thermal movement.
- B. Install on properly prepared substrate:
 - 1. Provide sub-framing and bracing required for panel system.
 - 2. Repair damaged substrate material prior to installation of this system.
- C. Provide separation of dissimilar metals.

3.3 PROTECTION

- A. Provide required temporary closures and flashings to maintain weather integrity, during and after erection.
- B. Clean exposed surfaces promptly after installation.
 - 1. Comply with panel manufacturer's specifications for cleaning.

END OF SECTION

SECTION 07 46 18
DRY JOINT METAL PANEL WALL SYSTEM (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Dry Joint Metal Panel Wall System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years experience.
- B. All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
- C. Provide engineering design performed and sealed by registered Structural Engineer (SE), licensed in the State of Illinois.
- D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
- E. Field Testing: Refer to Section 01 91 13 for testing requirements.
- F. Finish areas designated by Architect.
- G. Do not proceed with remaining work until workmanship, color, texture and sheen are approved by Architect.
- H. Refinish mock-up area as required to produce acceptable work.

1.3 DESIGN REQUIREMENTS

- A. Design and provide metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weather tight wall system based on AAMA - CW-RS -1-04 Rain Screen Principle, AAMA 508-7 Voluntary Test Method and Specifications for Pressure Equalized Rain Screen Wall Cladding Systems and Pressure Equalized Wall Design.
- B. Design wall systems and anchorage to meet Design Loads.
 - 1. Wind Loads – Use the greater of the following:
 - a. Wind Pressures listed on Design Requirements on Structural Drawings.
 - b. Wind Pressures defined by Building Code as locally adopted and amended.
 - c. 20 PSF Minimum.
- C. Design panel and support system to meet the following.
 - 1. Maximum panel deflection measured perpendicular to panel face on the longest diagonal length: L/60 at 150 percent maximum wind load.
 - 2. Maximum deflection of supporting channels or components : L/175 of span at 150 percent maximum wind load. Span is measured between the centerline of anchor points. Cantilever span is defined as two times the distance from anchor centerline to cantilever end.
- D. Pressure Equalization: ASTM E1233 Cyclic Static Air Pressure Differential Testing; Positive pressure loading to 1200 pa. 25PSF for 100 three second cycles.
- E. Air Leakage: Not more that 0.06 CFM/SF of wall area when tested at 6.24PSF in accordance with ASTM E283.

- F. Water Penetration ; Static: No water infiltration under static pressure when tested in accordance with ASTM E331 at a differential of 10% of inward acting design load, 15.00 PSF MIN. after 15 minutes.
- G. Water Penetration; Dynamic: AAMA 501.1 Dynamic Water Test at a minimum of 300 Pa 6.24 PSF.
- H. Audible harmonic vibrations and noises from thermal movement are not acceptable.
- I. No exposed sealants, gaskets, tapes or battens unless indicated.

1.4 PRE-INSTALLATION MEETING

- A. Schedule a pre-installation conference prior to commencement of field operations, to review installation procedures, construction sequence and establish process to maintain optimum working conditions. Coordinate work with related and adjacent work. Agenda of the conference shall include review of the substrate for being true and plumb with all moisture proofing components in place, secure and complete.

1.5 SUBMITTALS

- A. Shop Drawings:
 1. Indicate dimensions, profiles, and joint details. Indicate system flashings, fastening, anchor, and installation details.
 2. Indicate flashing and trim details at interface with glazing systems; including glazed-in panel system components details.
 3. Indicate extent of finish #1 and finish #2 on the project.

AD-1:

4. Layout and attachment details for snow guard system.

- B. LEED Information:

1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

- C. Samples:

1. Metal Wall Panels: 6 IN x 6 IN sample of specified finish.

AD-1:

2. Snow guard.

- D. Contract Closeout information:

1. Warranty.
2. Minutes of Pre-Installation Meeting.

1.6 WARRANTY

- A. Provide manufacturers standard two (2) year warranty from date of substantial completion, in which manufacturer agrees to repair or replace components of metal panel wall assemblies that fail in materials or workmanship within specified warranty period.
- B. Panel System Installer: Repair or replace products or components which fail due to faulty workmanship for a period of two (2) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Dry Joint Pressure-Equalized Rain Screen Metal Wall Panel System:
 - 1. Base:
 - a. Dri-Design.
 - 2. Optional:
 - a. Pohl Inc.
 - b. Firestone, Una-Clad.
 - c. Metal Design Systems
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIAL

- A. Base Product: Dry Joint Architectural Wall Panel System by Dri-Design.
- B. Preformed, prefinished metal panels with sealed corners.
- C. Panel Material:
 - 1. Aluminum, Anodized.

AD-4:

- 2. Thickness: 12GA. (0.080 IN).
 - 3. Overall depth of panel system to be 1-1/4 IN.
 - 4. Nominal joint width: 1/2 IN.
- D. Aluminum Panel Finish:
 - 1. Finish #1: Class 1 copper anodized.
 - a. To match architect's sample of Linetec ANO – 630 AE copper anodized finish.
 - b. Some variation in shade of color anodized finish is to be expected from panel to panel. Acceptable range in shade of color is represented by architect's range of samples.
 - c. Primary finish on project for dry joint panel system.
 - 2. Finish #2: Class 1 clear anodized.
 - a. Clear anodized dry joint panel system to be located at portions of the exterior soffit/ceiling at the west end of building under Second Floor slab. (Also turns up below the Second Floor Curtainwall at portions of the west facade.) Review locations as shown on drawings.
- E. Exposed moldings, flashing and copings: Match panel material and profiles indicated in drawings or required for installation.
- F. All mechanical fasteners to be stainless steel and concealed. Aluminum rivets may be used only at aluminum to aluminum connections or as noted.
- G. Substrate: See Section 09 21 27.
- H. Subgirts and supports:
 - 1. G60 galvanized subgirts and intermediate support items as required for installation.
- I. Pressure seal tape – to maintain seal against air/water infiltration at fastener penetrations of air barrier and sheathing.
- J. Fluid Applied Air Barrier, Vapor Resistive: See Section 07 27 26.
- K. Sealants: See Section 07 92 13.
- L. Accessories: Panel manufacturer's standard accessories as required by project conditions.
- M. Vertical Support Track Finish:
 - 1. Class 1 copper anodized.
- N. Brackets: Mill finish.

AD-1:

- O. Snow Guards
 - 1. Aluminum gusseted snow guards attached directly to horizontal, top side panels at Second Floor elevation.
 - 2. Provide appropriate snow guard and fasteners compatible with aluminum panel system.
 - 3. Fastener strength shall exceed that of the snow guard system.
 - 4. Set each snow guard in a bed of sealant prior to fastening.
 - 5. Base: Alpine Snowguards, #30 Snow Guard System or equal.
 - 6. Finish:
 - a. Copper anodized aluminum to match color of panels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine structure and components to support or receive panel system. Verify that structure is erected as set forth by the contract documents, and aligned to tolerances established by AISC Code of Standard Practice. Report deficiencies or discrepancies.
- B. Verify building waterproofing envelope and placement of structural components to receive and support the panel system. Report inadequacies prior to proceeding.
- C. Verify continuity of air barrier system throughout and that air barrier system installation is complete.
- D. Verify perimeter of curtain walls, doors, entry systems, and louvers have been properly tied into the air barrier system.
- E. Proceed with installation once deficiencies are corrected.

3.2 INSTALLATION

- A. Erect panel system plumb, level, and square, within tolerances and industry standards. Installation tolerances must remain within panel manufacturing tolerances and thermal movement tolerances and requirements.
- B. Provide pressure seal tape to maintain air-tight seal where furring fasteners will penetrate the air barrier and sheathing.
- C. Panel sizes and spacing as indicated on drawings.
- D. A variation in shade of color of the copper anodized finish is expected from panel to panel. Installation of panels shall result in a randomized installation of panels of differing color.
- E. Provide separation of dissimilar metals.

AD-1:

- F. Joints in skyward-facing horizontal panels.
 - 1. No panel joints shall be permitted perpendicular to drainage.
 - 2. At all skyward-facing panel joints running parallel to drainage, provide continuous sealant for water-tight joint.

3.3 CONTROL / EXPANSION JOINTS

- A. Construct control and/or expansion joints where indicated.

3.4 CLEANING

- A. Clean work under provisions of Division 1.
- B. Refer to manufacturer cleaning instructions.

SECTION 07 54 25
FULLY ADHERED TPO ROOFING (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Fully Adhered TPO Roofing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicator qualifications: Manufacturer authorized roofing installer.
- B. References:
 - 1. SPRI: "Wind Load Design Guide for Low Sloped Flexible Membrane Roofing Systems."
 - 2. Factory Mutual (FM) Research Corporation: "Loss Prevention Data Sheets 1-28, 29, and 49."
 - 3. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
- C. Material Standards:
 - 1. TPO Membrane: ASTM-D6878.
- D. Comply with Energy Star criteria for roofing membrane albedo.
- E. Testing Requirements: Refer to Section 01 91 13 for testing requirements.

1.3 DESIGN CRITERIA

- A. Design roof system and anchorage, including roof covering and metal edge securement to meet Design Loads.
 - 1. Wind Loads – Use the greater of the following:
 - a. Wind pressures listed on Design Requirements on Structural Drawings.
 - b. Wind pressures defined by Building Code as locally adopted and amended.
 - c. 25 PSF Minimum.
 - 2. Roof Loads – Use the greater of the following:
 - a. Snow loads listed on Design Requirements on Structural Drawings.
 - b. Snow loads defined by Building Code as locally adopted and amended, including drifting.
 - c. 30 PSF Minimum.
- B. Design roof system, including roof covering and metal edge securement to satisfy requirements of:
 - 1. Applicable building codes including local amendments:
 - 2. Requirements applicable to designated warranty.
 - 3. Roof Height(s) and Parapet Height(s): As indicated.
 - 4. Static Pressure of Building Interior: < 0.5 IN water.
- C. Fire resistance rating:
 - 1. UL 790, Class A.
 - 2. Assembly in conformance with fireproofing as specified.
- D. Design the adhered membrane roofing system to comply with:
 - 1. FM 1-90.

1.4 PRE-INSTALLATION MEETING

- A. Pre-installation meeting, directed by Contractor, prior to beginning of roofing work to discuss following:
 - 1. Contract Document requirements.
 - 2. Roof plan.
 - 3. Roofing and flashing details.
 - 4. Drain and scupper elevations.
 - 5. Roofing manufacturer's specifications and details.
 - 6. UL requirements.
 - 7. Insulation manufacturer's recommendations.
 - 8. Available on site storage.
 - 9. Roof protection from damage by other trades.
- B. Attendance is recommended for:
 - 1. Contractor.
 - 2. Roofing installer's superintendent.
 - 3. Roofing manufacturer's representative.
 - 4. Sheet metal installer performing metal flashing work.
 - 5. Mechanical installer.
 - 6. Plumbing installer.
 - 7. Deck installer.
 - 8. Other trades whose work may affect roofing system.
- C. Minimum two weeks prior to meeting forward pertinent information to Contractor for review.
 - 1. Installation drawings.
 - 2. Manufacturer product data.
 - 3. Samples of proposed materials.
 - 4. Sample warranty.
 - 5. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.
- E. Objectives of pre-installation meeting to include:
 - 1. Review foreseeable methods and procedures related to roofing work.
 - 2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.
 - 3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
 - 4. Review roofing system requirements (drawings, specifications and other contract documents).
 - 5. Review required submittals both completed and yet to be completed.
 - 6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - 7. Review required inspection, testing, certifying and material usage accounting procedures.
 - 8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - a. Review notification procedures for weather or non-working days.
 - 9. Record discussion of conference including decisions and agreements (or disagreements) reached.
 - a. If substantial disagreements exist at conclusion of meeting, determine how disagreements will be resolved and set date for reconvening meeting.
- F. Furnish copy of record to each party who may be affected by roofing work, (weather or not they were in attendance) and to Laboratory and Architect.

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. Roof layout showing insulation thicknesses, walkway pads, and special details.
 - 2. Profiles of flashing and coping assemblies.
 - 3. Installation Drawings and pertinent details showing all required components of system.
 - 4. Indicate location of expansion joints, crickets, saddles, curbs, safety tiebacks, vents, drains, lightning protection, screen wall supports, scuppers, and other penetrations.
 - 5. Indicate insulation layout showing slope amount and direction, locations of crickets, and key vertical elevation points.
 - 6. Interfaces with all adjacent materials and assemblies.
 - a. Glazing of roofing system flashing into curtainwall sills.
 - b. Manufacturer's accepted interface where roofing system overlaps air barrier system; including barrier material to separate two systems when deemed necessary by Roofing System Manufacturer.
- B. Samples:
 - 1. 5 IN x 5 IN specimens of sheet goods.
 - 2. Color swatches of sheet metal colors for pre-selection.
 - 3. 3 IN x 5 IN samples of sheet metal color(s) for final approval.
- C. Product Data: For each component of system.
- D. Project Information:
 - 1. Meeting minutes from pre-installation meeting.
 - 2. Report by manufacturer's representative that roof has been properly installed.
- E. Contract Closeout Information:
 - 1. Warranty.
 - 2. Maintenance Data:
 - a. Include cleaning instructions.
- F. LEED Information:
 - 1. SS 7.2, Heat Island Effect – Roof: Manufacturer's product data indicating SRI (Solar Reflectance Index) of roofing membrane.
 - 2. MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 3. MR 5.1 & 5.2 –Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.6 WARRANTY

- A. 15-year warranty of weathertightness signed by roofing materials manufacturer.
 - 1. Warranty to include coverage for peak gusts of wind to:
 - a. 55 MPH at 33 FT above ground.
 - 2. Warranty to include the entire system: membrane, vapor barrier, flashings, adhesives, sealants, counterflashings, insulation, fasteners, fastener plates, fastener strips, hard rubber or metal edging, metal termination bars, sheet metal copings and edge metal, and other material authorized by manufacturer.
- B. 20-year warranty on 70% PVDF (Kynar 500) coatings on edge metal and copings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Roofing materials:
 - 1. Base:
 - a. Carlisle SynTec.
 - 2. Optional:
 - a. Firestone Building Products.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 GENERAL

- A. All components products made by, or accepted as “compatible” by membrane manufacturer.
- B. Unless otherwise approved by the specifier and accepted by the membrane manufacturer, products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.

2.3 SHEATHING

- A. Gypsum Sheathing (where roofing is to be installed over metal decking or existing roofing):
 - 1. Water-resistant gypsum core with fiberglass facings.
 - 2. Minimum Thickness:
 - a. 5/8 IN.
 - 3. Base Product: “Dens-Deck Roof Board” by Georgia-Pacific.

2.4 VAPOR RETARDER

- A. Vapor Retarder:
 - 1. Two plies of polyethylene, bonded over one layer of scrim reinforcing.
 - 2. Fire retardant type, with compatible fire retardant adhesive.
 - 3. Base Product: “TX-1200 FR” by Griffolyn.
 - 4. Optional: Fortifiber, with tape by Ideal.

Minimum Physical Properties – Vapor Retarder		
Property	Test Method	Required Value
Puncture Propagation Tear	ASTM-D256	116 N 26 LBS
Permeance	ASTM-E96	2.06 ng/Pa-s-M2 0.036 Perm (US)
Drop Dart	ASTM-D1709, Method B	330 g
Tensile Strength	ASTM-D882	445 N / 31,058 kPa 100 LBS / 4,504 PSI
Puncture Strength	ASTM-D4833	116 N 26 LBS
Surface Burning Characteristics	ASTM-E84	Class I, Class A

- 5. Seaming Tape:
 - a. Self-adhering, asphaltic mastic.
 - b. Base Product: “Fab Tape” by Griffolyn.
- 6. Repair Tape, for punctures and other damaged areas:
 - a. Base Product: “Griff Tape” by Griffolyn.

2.5 ROOF INSULATION

- A. General:
 - 1. Furnished by roofing manufacturer.
 - 2. UL listed for assembly indicated.
 - 3. Provide crickets and saddles as required.
 - 4. Insulation shall be installed in multiple layers with joints staggered.

- a. Where no Sheathing is specified over Metal Decking: The minimum thickness of the first insulation layer shall be at least 1/2 of the span distance between flutes of the decking.

AD-4:

- b. The first layer of insulation shall be mechanically fastened to the substrate in accordance with the manufacturer’s published specifications.
- c. Subsequent layers of insulation shall be adhered in accordance with the manufacturer’s published specifications.

B. Polyisocyanurate (PISO) roof insulation:

- 1. Rigid, closed cell foam core bonded to heavy-duty glass fiber mat facers.
- 2. Material complying with:

Minimum Physical Properties – Polyisocyanurate Insulation		
Property	Test Method	Required Value
Material Standards	ASTM-C1289	Type II, Class 1
	HH-I-1972	Class 1
Density (nominal)	ASTM-D1622	2 PCF
Long Term Thermal Resistance (LTTR) per unit thickness	CAN / ULC-S770	6.0 R per IN
Compressive Strength	ASTM-D1622	20 PSI
Dimensional Stability	ASTM-D2126	2% max., 7 days
Permeance	ASTM-E96	<1.0 Perm (US)
Water Absorption	ASTM-C209	< 1.5% volume
Service Temperature	--	-100 to +250 DegF

- 3. Minimum Insulation Thickness:
 - a. Areas where “Tapered” insulation is indicated:
 - 1) Minimum R=30 at roof drains (except where specifically indicated otherwise).
 - 2) Taper to provide slope of 1/4 IN per FT.
 - b. Areas with uniform insulation thickness (sloped structures):
 - 1) Minimum R=30 at roof drains.
- 4. Base Product: “Sure-Seal Polyisocyanurate HPH” by Carlisle SynTec.
- 5. Optional: “Iso 95+ GL” by Firestone.

C. Cover Board (Gypsum-based):

- 1. Water-resistant gypsum core with fiberglass facings.
- 2. Minimum Thickness:
 - a. 1/2 IN.
- 3. Base Product: “Dens-Deck Roof Board” by Georgia-Pacific.

2.6 ROOFING MEMBRANE

A. TPO Roofing membrane:

- 1. Material: Thermoplastic Polyolefin (TPO) single-ply roofing membrane.
 - a. Fire Retardant.
 - b. Polyester fabric reinforced.
- 2. Color: White.
- 3. Thickness: 60 mil thick.
- 4. Base Product: “SureWeld” by Carlisle SynTec.
- 5. Optional: “UltraPly TPO” by Firestone.
- 6. Minimum Physical Properties:

Minimum Physical Properties – 60mil, Reinforced, TPO Membrane		
Property	Test Method	Required Value
Tolerance on Nominal Thickness (Max)	ASTM-D751	+/- 10%
Thickness over scrim (Min)	ASTM-D4637	15 mil
	Optical	18 mil
Breaking Strength (Min)	ASTM-D751	225 LBS
	Grab Method	340 LBS
Ultimate Elongation – Fabric Failure (Min)	ASTM-D751	25%
Tear Strength (Min)	ASTM-D751	55 LBS
	B Tongue Tear	130 LBS
Linear Dimensional Change (Shrinkage)	ASTM-D1204	+/- 1.0%
Field Seam - Peel Strength (min)	ASTM-D1876	40 LBS/IN
Permeance (max)	ASTM-E96	<0.1 Perm (US)
Puncture Resistance (min)	FTM 101C Method 2031	250 LBS
Solar Reflectance (albedo X 100) (3 year aged value)	ASTM-E903	80 (White Membrane)
Brittleness Point	ASTM-D2137	-40 DegF

B. Membrane flashings, fasteners, adhesives, tapes, cements and sealants: Roofing manufacturer's standard.

2.7 EDGE METAL AND COPING

A. General:

1. Roofing Manufacturer's pre-engineered, prefabricated system for termination of roofing membrane.
2. All fasteners must be concealed from view.
3. Concealed splice plates, with color matching snap-on covers.
4. Anchor cleats:
 - a. Material: G90 galvanized steel.
 - b. Thickness: 20 GA.
5. Wind Rating: Design for same FM design pressure indicated for balance of roof system.
6. Coverage of these items to be included in roof system warranty.
7. Comply with applicable FM and SPRI standards.

B. Coping/roof edge conditions where interfacing with Dry Joint Metal Wall Panel system below:

1. Coping/roof edge panels to be integral with Dry Joint Metal Wall Panel System are to be provided under Section 07 46 18.

AD-4:

C. Coping conditions where interfacing with Curtain Wall System below:

1. Coping to be integral with Curtain Wall System is to be provided under Section 08 44 13.

D. Coping conditions where interfacing with Preformed Exposed Fastener Metal Panel system below to be provided under this Section as follows:

1. Match profiles indicated.
2. Include accessories such as pre-fabricated inside and outside corners (seamed), End Caps, Saddles, Tee's, Crosses, Transition Pieces and Radiused Copings, and other items indicated.
3. Provide insulation and cover board under copings as detailed.
4. Base Product: "SecurEdge 200 Coping" by Carlisle SynTec.
5. Material: Aluminum, 1.2 mm 0.05 IN.
6. Thickness:
 - a. 22 GA.
7. Finish: Kynar 500.

8. Color: To be selected from manufacturers standard and premium colors by Architect or custom if necessary (to coordinate with color of metal panel cladding).

2.8 FASTENERS

- A. Type, spacing and quantity as recommended by manufacturer.
 1. Designed to resist uplift forces generated by specified wind speed.
- B. Minimum pullout values per fastener:
 1. For use with 22 GA steel decks: 350 LBS each.
 2. For use with normal weight concrete decks: 800 LBS each.
- C. Fasteners shall be capable of providing a static back-out resistance of at least 10 IN-LBS.

2.9 WALKWAYS

- A. Walkway:
 1. Manufacturer's standard walkway roll stock, designed to protect TPO roof membrane.
 - a. Slip-resistant surface.
 2. Nominal Thickness: 15 mil.
 3. Width: 30 IN.
 4. Color: To be selected by Architect from manufacturer's standard line.
 5. Secure by heat welding tape as recommended by membrane manufacturer.

2.10 MISCELLANEOUS ITEMS

- A. Roofing accessories:
 1. Use manufacturer's standard prefab accessories where available.
 2. Nailing strips: As detailed and required.
 3. Pipe flashings: Provide for each pipe penetration; include clamps, adhesive and sealants.
 4. Expansion joint covers – Specified in Section 07 95 14.
 5. Underlayment for pavers: As recommended by roofing manufacturer.
- B. Adhesives, cleaners, and primers: As recommended by roofing manufacturer.
- C. Treated Wood Blocking: Specified in Section 06 10 53.
- D. Other Materials as required by manufacturer for complete system warranty.

2.11 SCHEDULE OF ROOF SYSTEMS

- A. Roof System 1 – Fully Adhered TPO over Cast-in-Place Concrete Deck.
 1. Vapor retarder.
 2. 5" insulation uniform throughout.
 3. Tapered insulation
 4. Cover Board.
 5. TPO Membrane (fully adhered).
 6. Minimum Solar Reflectance Index of 80.
 7. Minimum R-Value = 30.
- B. Roof System 2 – Fully Adhered TPO over Cast-in-Place Concrete Deck. (Located only at Penthouse level overhang above north entrance - no conditioned space below).
 1. Vapor retarder.
 2. 3" insulation uniform throughout.
 3. Tapered insulation
 4. Cover Board.
 5. TPO Membrane (fully adhered).
 6. Minimum Solar Reflectance Index of 80.
 7. Minimum R-Value = 21.
- C. Roof System 3 - Fully Adhered TPO over Composite Deck.
 1. Vapor retarder.

2. 5" insulation uniform throughout.
 3. Cover Board.
 4. TPO Membrane (fully adhered).
 5. Minimum Solar Reflectance Index of 80.
 6. Minimum R-Value = 30.
- D. Roof System 4 – Fully Adhered TPO over Composite Deck. (Roof of Corridor D170 and Entry Vestibule D169 only).
1. Vapor retarder.
 2. 3" insulation uniform throughout.
 3. Tapered insulation
 4. Cover Board.
 5. TPO Membrane (fully adhered).
 6. Minimum Solar Reflectance Index of 80.
 7. Minimum R-Value = 21.
- E. Roof System 5 – Fully Adhered TPO over Steel Deck:
1. Gypsum Sheathing.
 2. Vapor Retarder.
 3. 5" insulation uniform throughout.
 4. Tapered insulation.
 5. Cover Board.
 6. TPO Membrane (fully adhered).
 7. Minimum Solar Reflectance Index of 80.
 8. Minimum R-Value = 30.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect entire area to be roofed for acceptability.
 1. Correct, or have corrected, unsatisfactory conditions.
- B. A representative of manufacturer shall make an inspection and issue written report to Architect that roofing system has been installed properly.

3.2 PREPARATION

- A. Remove standing water from area to be covered prior to starting roofing work.
- B. Install required nailers.
- C. Clear the deck of debris, ice, water and foreign material prior to installation of any roofing materials.

3.3 INSTALLATION OF ROOFING - GENERAL

- A. Install materials in accordance with manufacturer's instructions and recommendations.
- B. Comply with code, design, and warranty requirements.
- C. Fasteners which will be exposed to view from finished spaces below:
 1. Project fastener through roof deck maximum 1 IN and cap.
- D. Comply with the manufacturer's instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.
- E. Install materials in accordance with procedures required for FM and UL assemblies.

3.4 INSTALLATION OF NAILERS

- A. Install nailers at perimeter of each roof level, curbs, skylights, expansion joints, and similar penetrations.

3.5 INSTALLATION - SHEATHING (OVER METAL DECK)

- A. Lay sheathing tightly butted and cut to fit around penetrations.
- B. Apply per UL requirements.
- C. Attach sheathing to deck in accordance with roofing manufacturer's recommendations.

3.6 INSTALLATION - VAPOR RETARDER

- A. Install in accordance with manufacturer's instructions.
- B. Ensure that surface beneath vapor retarder is smooth with no sharp projections.
- C. Do not proceed until deficiencies are corrected.
- D. Install in largest practical widths.
- E. Install continuously at locations indicated.
 - 1. Insure that no discontinuities occur, including at seams, penetrations, and edge terminations.
 - 2. Join sections of vapor retarder and seal penetrations with mastic tape.
 - 3. Lap joints 4 IN and seal with adhesive.
 - 4. Ensure that surfaces to be taped are clean and dry.
- F. Seal around pipes, conduits, curbs, safety tie-backs, and other penetrations with pipe boots in accordance with manufacturer's instructions.
- G. Maintain continuity of vapor retarder over expansion joints.
- H. Repair holes in vapor retarder with self-adhesive tape recommended by manufacturer.
- I. Protect vapor retarder from damage until covered with insulation.

3.7 INSTALLATION - WOOD BLOCKING

- A. Install where indicated or required for proper securement of roofing system.
- B. Securement of wood blocking:
 - 1. Design to resist a minimum of 200 LBS/LF in any direction per SPRI Test Method RE-1.
- C. Install so that top of blocking is substantially flush (+/- 1/4 IN) with top of insulation.

3.8 INSTALLATION - INSULATION

- A. Where required thickness of insulation is greater than 2 IN: Install insulation in at least two layers.
 - 1. Stagger board joints in successive layers laterally, and longitudinally.
 - 2. Butt joints tightly, and dress top surface of joints as required to preclude ponding at seams.
 - a. Joints shall not exceed 1/4 IN.
 - b. Joints and gaps greater than 1/4 IN shall be filled with the same material.
 - 3. Cut insulation neatly to fit around roof penetrations and projections.
- B. Maximum thickness of a single layer of insulation not to exceed 2 1/2 IN.
- C. Secure insulation to the substrate with the required mechanical fasteners and adhesive as indicated below and in accordance with the manufacturer's specifications.
 - 1. Cut insulation neatly to fit around roof penetrations and projections.
 - 2. Install Cover Board continuously over insulation.
 - 3. Mechanically fasten bottom layer of insulation to deck to UL and FM requirements and subsequent layers of insulation shall be adhered.

AD-4:

- a. Where Cover Board is specified, it shall be adhered in accordance with the manufacturer's published specifications.

D. Fasteners which will be exposed to view from finished spaces below:

1. Project fastener through roof deck maximum 1 IN and cap.

3.9 INSTALLATION – MEMBRANE

A. General:

1. Unroll and position membrane without stretching.
2. Secure the membrane with the required fasteners and plates.
 - a. Spacing as dictated by wind design and project conditions.
3. Install adjoining membrane sheets in the same manner in accordance with the manufacturer's requirements.
4. Position sheets to accommodate contours of roof deck.
 - a. Shingle splices to avoid bucking water.
5. Perimeter Securement: Secure membrane along the perimeter of each roof level, roof section, curb, skylight, interior wall, penthouse, and other penetrations as recommended by membrane manufacturer.
6. Hot or Cold Weather Procedures: Comply with manufacturer's instructions.
7. Protect membrane from stains/discoloring caused by adhesives.

B. Adhering TPO Membrane:

1. Position TPO membrane over substrate.
2. Fold membrane sheet back lengthwise (onto itself) so half the underside of the membrane is exposed.
3. Apply bonding adhesive in accordance with the manufacturer's instructions, to the exposed underside of the membrane and the corresponding substrate area.
 - a. Do not apply bonding adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet.
 - b. Allow the adhesive to dry until it is tacky.
 - c. Roll the coated membrane into the coated substrate while avoiding wrinkles.
 - d. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
 - e. Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.

C. Membrane Splicing/Hot Air Welding Procedures:

1. Position adjoining sheets to allow a minimum overlap of 2 IN.
2. Hot air weld TPO membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.
 - a. At splice intersections, roll the seam with a roller prior to membrane seam cooling.
 - b. Where 60 mil membrane is specified: Splice intersections shall be overlaid with non-reinforced TPO flashing material (of type recommended by membrane manufacturer).
3. Probe seams once the hot air welds have thoroughly cooled (approximately 30 minutes).
4. Repair seam deficiencies the same day they are discovered.
5. Apply sealant (of type recommended by membrane manufacturer) on cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete.
6. Pull the membrane back along the welded splice so the entire underside of the membrane is exposed once the Hot Air Weld has been completed.
 - a. Apply bonding adhesive to the exposed underside of the membrane sheet and the substrate.
 - b. Allow adhesive to dry until tacky and roll the membrane into the substrate and brush down the bonded section with a bristle broom following the procedure noted above.
 - c. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 IN and complete the bonding procedures as stated previously.

D. Flashing:

1. Follow manufacturer's typical flashing procedures for wall, curb, and penetration flashing including metal edging/coping and roof drain applications.
2. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced TPO membrane.
3. Manufacturers standard, non-reinforced TPO membrane can be used for flashing pipe penetrations, sealant pockets, scuppers, as well as inside and outside corners when the use of pre-fabricated accessories is not feasible.
4. Terminate base-of-wall flashings in accordance with manufacturer's approved details.
5. Pre-flashing at sheet metal parapet copings:
 - a. Extend TPO membrane, flashing or both over top of parapet prior to capping with sheet metal.
6. Expansion Joints:
 - a. Extend TPO membrane across roofing expansion joints.
 - b. Include adequate slack in membrane to accommodate anticipated movement.

3.10 INSTALLATION - EDGE METAL AND COPING

- A. Verify that blocking has been installed and adequately secured.
- B. Sub-flash details with a layer of TPO membrane prior to installation of edge metal or coping system.
- C. Secure anchor cleat to blocking as recommended, using corrosion-resistant fasteners.
- D. Install splice plates and snap-on covers.
- E. Protect finished items from damage for balance of construction period.
 1. Repair/replace damaged items.

3.11 INSTALLATION – WALKWAYS

- A. Install walkways at traffic concentration points, such as roof hatches, access doors, rooftop ladders, etc., and locations as indicated.
 1. Do not locate within 10 FT of roof edge.
- B. Clean surfaces to be bonded.
- C. Secure by heat welding as recommended by membrane manufacturer.

3.12 DAILY SEAL

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
 1. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.
- B. Remove temporary water cutoffs prior to proceeding with next work period.
 1. Remove and replace wet insulation.

3.13 CLEAN UP

- A. Remove all construction debris and legally dispose off site.

END OF SECTION

SECTION 07 62 00
FLASHING AND SHEET METAL (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Flashing And Sheet Metal, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Reference standards:
 - 1. As noted for individual items.
 - 2. ASTM Standards.
 - 3. Architectural Sheet Metal Manual by SMACNA, current edition.
 - 4. Refer to Section 01 91 13 for testing requirements.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Details.
- B. Samples:
 - 1. For finish, color and color range selection.
- C. Contract Closeout Information:
 - 1. Warranty.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 WARRANTY

- A. Furnish twenty (20) year finish warranty on PVDF coated sheet metal, covering color, fade, chalking and film integrity.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Formed Sheet Metal items:
 - 1. Base:
 - a. Ryerson/Integris Metals, ColorKlad.
 - 2. Optional:
 - a. Petersen Aluminum.
- B. Sheet metal systems:

- C. Reglets:
 - 1. Base:
 - a. Fry Reglet.
- D. Roofing expansion joint cover:
 - 1. Base:
 - a. John Mansville.
- E. Other materials:
 - 1. Base:
 - a. Manufacturers as noted.
- F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS – GENERAL

- A. Sheet Metal - Aluminum, PVDF-coated:
 - 1. Sheets and plates: ASTM-B209.
 - 2. Extrusions: ASTM-B290.
 - 3. PVDF-coating: Minimum 1 mil fluorocarbon coating, 70% PVDF (Kynar/Hylar).
 - a. Color(s):
 - 1) To be selected by Architect from manufacturer’s standard and premium lines.
- B. Sheet Metal - Stainless Steel:
 - 1. ASTM-A167 or ASTM-A176,
 - 2. Type 304 with ASTM-A480 Finish No.4 where exposed.
 - a. Type 302 0or 304 where concealed.
 - 3. Minimum 24 GA, soft annealed.

2.3 SHEET METAL FABRICATIONS

AD-4:

- A. Hanging Gutters:
 - 1. Fabricate to size and profile indicated, complete with end pieces, outlet tubes, and other accessories as required.
 - a. Gutters shall be complete with mitered corners, end caps, and outlets sized to fit downspouts.
 - 2. Material:

Hanging Gutters - Minimum Sheet Thickness / Weight					
Material	Gutter Girth				
	up to 380mm 15 IN	410 to 510mm 16 to 20 IN	430 to 630mm 21 to 25 IN	660 to 760mm 26 to 30 IN	790 to 890mm 31 to 35 IN
PVDF coated Aluminum	0.81mm 0.032 IN	1.02mm 0.040 IN	1.27mm 0.050 IN	1.60mm 0.063 IN	--

- B. Downspouts:
 - 1. Fabricate downspouts to size and profile indicated complete with formed or mitered elbows.
 - 2. Downspout Material:
 - a. PVDF coated Aluminum: Minimum 0.024 IN thick.
 - 3. Shape: Rectangular.
 - 4. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 5. Downspouts shall be fabricated in minimum 10 FT lengths with section ends formed for minimum 13 mm 1/2 IN telescoped and locked joints.
 - 6. Downspouts shall be complete with wire ball strainers for gutter outlets, and indicated elbows and offsets.

7. Downspout supports shall include minimum 0.040 IN thick clips, minimum 3mm 0.125 IN thick anchors, and minimum 0.060 IN thick by 2 IN wide leader straps or rack and pin type fasteners of length to allow minimum 1 IN clearance between downspout and building wall, provided in sufficient number to be located at maximum 5 FT on center.
- C. Through Wall Parapet Scuppers:
1. Fabricate scuppers of dimensions indicated with closure flange trim to exterior, 4 IN wide wall flanges to interior, and base extending 4 IN beyond cant or tapered strip into field of roof.
 2. Scupper Material:
 - a. Stainless Steel: Minimum 0.019 IN thick.
- D. Conductor Heads:
1. Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shapes indicated.
 2. Include outlet tube and exterior flange trim.
 3. Include built-in overflows where indicated.
 4. Conductor Head Material:
 - a. PVDF coated Aluminum: Minimum 0.032 IN thick.
- E. Base of Wall Flashing at Foundation Insulation:
1. Material:
 - a. Stainless steel: Minimum 0.025 IN thick.

2.4 ACCESSORIES

- A. General:
1. Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by flashing manufacturer.
- B. Fasteners:
1. Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by flashing manufacturer.
 2. Blind fasteners or self drilling screws, gasketed, with hex-washer head.
 3. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 4. Blind Fasteners: High strength aluminum or stainless steel rivets suitable for metal being fastened.
 5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 6. Fastener Materials:
 - a. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Cleats (retainers): 16 GA galvanized or stainless.
- D. Dissimilar metal and cementitious materials protection:
1. Alkali resistant bituminous paint.
 2. Tnemec Tneme Tar 46-413.
- E. End dams for through wall flashing:
1. Provide end dams at opening heads, sills, and flashing terminations.
 2. Turn up ends minimum of 2 IN.
 3. Material:
 - a. Stainless steel: Minimum 0.019 IN thick.
- F. Base Flashing:
1. General (unless noted otherwise)
 - a. Fabricate to size and profile indicated.

- b. Material:
 - c. PVDF coated Aluminum: Minimum 0.040 IN thick.
 - 2. At grade or immediately above grade (where noted on drawings):
 - a. Fabricate to size and profile indicated.
 - b. Material:
 - 1) Stainless Steel: Minimum 0.019 IN thick.
- G. Counterflashing:
 - 1. General (unless noted otherwise)
 - a. Fabricate to size and profile indicated.
 - b. Material:
 - 1) PVDF coated Aluminum: Minimum 0.032 IN thick.
 - c. Provide interior and exterior preformed corners as required.
 - d. Fabricate as required to fit special conditions.
 - 2. At grade or immediately above grade (where noted on drawings):
 - a. Fabricate to size and profile indicated.
 - b. Material:
 - 1) Stainless Steel: Minimum 0.019 IN thick.
 - c. Provide interior and exterior preformed corners as required.
 - d. Fabricate as required to fit special conditions.
- H. Flashing Reglets:
 - 1. Fabricate to size and profile indicated.
 - 2. Material:
 - a. PVDF coated Aluminum: Minimum 0.032 IN thick.
 - 3. Provide interior and exterior preformed corners as required.
 - 4. Fabricate as required to fit special conditions.
- I. Expansion joint cover, roofing:
 - 1. Flexible, insulated bellows.
 - 2. 36 mil thick chlorinated polyethylene sheet permanently anchored between and sealed to stainless steel flanges of design required, in maximum available lengths; insulated with 3/8 IN thick closed cell foam.
 - 3. Corners and intersections: Manufacturer's standard prefabricated units.
 - 4. Splicing strips and adhesives: Manufacturer's standard neoprene splicing strips and adhesives.
- J. Sealants: Specified in Section 07 92 13.

2.5 FABRICATION

- A. General:
 - 1. Fabricate true and sharp to profiles and sizes indicated.
 - 2. Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA Architectural Sheet Metal Manual, that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated.
 - 3. Shop fabricate items to greatest extent possible.
 - 4. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 5. Form sheet metal flashing and trim without oil canning, buckling, and tool marks, true to line and level indicated, with exposed edges folded back to form hems.
 - 6. Conceal fasteners and expansion provisions where possible. Exposed fasteners not allowed on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim to tolerance of 1/4 IN on slope and location lines as indicated and within 1/8 IN offset of adjoining faces and alignment of matching profiles.
- C. Sealed Joints: Form movable joints in metal to accommodate elastomeric sealant.

- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 IN deep. Fill with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams in metals with painted, coated or lacquered finishes:
 - 1. Fabricate nonmoving seams with flat-lock seams.
 - 2. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- H. Seams in Stainless Steel sheet metals:
 - 1. Fabricate nonmoving seams with flat-lock seams.
 - 2. Tin edges to be seamed, form seams, and solder.
- I. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

- A. Verify suitability of substrates to accept work.
 - 1. Verify continuous wood blocking sloped 1:12, and covered with one layer of building paper or roofing membrane.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Fabricate and install in accordance with details and recommendations of SMACNA, current edition.
- B. Set shop fabricated interior and exterior preformed corners and intersections.
- C. Set top edges of flashings into reglets as indicated.
- D. Fasten materials at recommended intervals.
- E. Provide slip joints to allow for thermal movement.
 - 1. Use SMACNA Table 3-1, Design J9 - J12, with caulked lap.
 - 2. Maximum spacing: 10 FT on center.
 - 3. Provide slip joint in conjunction with splices and corners.
- F. Calk joints with 2 beads of sealant on each overlap: See Section 07 92 13.
- G. Turn down cap flashing over base flashings 4 IN and calk.
- H. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures.
- I. Provide dissimilar metals and materials protection where dissimilar metals come in contact, or where sheet metal contacts mortar or concrete.
- J. Provide miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.
- K. Provide continuous cleats.

3.3 INSTALLATION – CONDUCTOR HEADS AND DOWNSPOUTS

- A. Install conductor heads below slope line of roof, supported by continuous cleats.
- B. Install downspouts supported by leader straps or concealed rack and pin type fasteners at top, bottom and intermediate points not exceeding 5 FT on center.
- C. Install downspout 25 mm 1 IN clear of building wall.

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3.4 INSTALLATION - ROOFING EXPANSION JOINT COVERS

- A. Comply with manufacturer's instructions for handling and installation of elastic expansion joint materials.
- B. Coordinate installation and associated work to provide a complete system complying with recommendations of manufacturer and installer.
- C. Extend over curbs, parapets, gutters, valleys, fascias and other elements in construction, to provide continuous, uninterrupted, watertight expansion joint.
- D. Provide uniform hump throughout length of installation.
- E. Do not stretch elastic sheet.
- F. Anchor edges of units in compliance with manufacturer's instructions.
- G. Provide not less than 4 IN embedment in bituminous membranes, mop in with hot bitumen or with roofing cement.
- H. Cover with composition stripping.

3.5 CLEAN-UP

- A. Upon completion of work, repair damaged areas.
- B. Repair finish of PVDF coated flashing which fades or is damaged.
- C. Clean stains and debris.
- D. Remove protective coverings.

END OF SECTION

SECTION 07 72 33
ROOF HATCHES (Revised AD-4)

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. ASTM-A36: "Standard Specification for Structural Steel."
- B. ASTM-A123: "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
- C. Occupational Safety & Health Administration (OSHA): 29 CFR 1910.23 "Fall Protection in General Industry."

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Show profiles, accessories, locations and dimensions.
- B. Product Data:
 - 1. Manufacturer's literature for listed materials.
- C. Contract Closeout Information:
 - 1. Warranty.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.3 WARRANTY

- A. General:
 - 1. Products to be free of defects for period indicated.
 - 2. Warranty to cover repair or replacement in event of leakage, defective design, materials or construction.
- B. Roof Hatches:
 - 1. Provide 5-year warranty on Roof Hatches, including caulking and flashing.
- C. Hatch Guardrails:
 - 1. Provide 25-year warranty.

1.4 PRODUCT HANDLING

- A. All materials shall be delivered in manufacturer's original packaging.
- B. Store materials in a dry, protected, well-vented area.
- C. Remove protective wrapping immediately after installation.

1.5 JOB CONDITIONS

- A. Verify that other trades with related work are complete before installing roof hatches and hatch guardrail system(s).
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.
- D. Coordinate installation with roof membrane and roof insulation manufacturer's instructions.
- E. Observe appropriate OSHA safety guidelines for this work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable Manufacturers:
 - 1. Roof Hatches:
 - a. Base:
 - 1) Bilco Company.
 - b. Optional:
 - 1) Wasco Products.
 - 2) Milcor.
 - 2. Hatch Guardrail:
 - a. Base:
 - 1) Bilco Company.
 - b. Optional:
 - 1) KeeHatch.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 SCHEDULE OF ROOF HATCHES

- A. Size and corresponding Base Model Number ("Bilco"):

AD-4:

- 1. Size: 30 IN x 54 IN; Bilco Series "NB-50T."
- B. Roof Hatch Materials (Galv Steel Units):
 - 1. Curb and Cover Material: 0.067 IN (14 GA) Steel sheet: Zinc coated, galvanized, ASTM-A653 G90.
 - 2. Cover Liner Material: 0.026 IN (22 GA) Steel sheet: Zinc coated, galvanized, ASTM-A653 G90.
 - 3. Finish:
 - a. Shop Primer: Manufacturer's standard primer, minimum 2.0 mils dry.
 - b. Field Finish: Paint as specified in Section 09 91 13.
- C. Include the following at each Roof Hatch:
 - 1. Hatch Guardrail.

2.3 ROOF HATCHES - CONSTRUCTION

- A. Curb:
 - 1. Height: 12 IN.
 - 2. Formed with a 3-1/2 IN flange with 7/16 IN holes provided for securing to the roof deck.

3. The curb shall be equipped with an integral metal cap-flashing of the same gauge and material as the curb, fully welded at the corners that features the Posi-Flash flashing system including stamped tabs, 6 IN on center, to be bent inward to hold EPDM roofing securely in place.
- B. Cover:
1. Minimum 2-1/2 IN weather flange.
- C. Insulation:
1. Rigid board glass or mineral fiber, laminated between sheets of metal.
 2. Insulate curbs and covers with minimum 1 IN thick insulation.
- D. Gaskets: Tubular or fingered design; neoprene, polyvinyl chloride, or molded block design sponge neoprene.
- E. Hardware:
1. Standard self-lifting mechanism and automatic hold open devices.
 2. Pintle hinges.
 3. Operating devices: Handles and padlock hasps on inside and outside.
 4. Finish: Cadmium plated.
- F. Performance Characteristics:
1. Construct for 40 PSF live loading with a maximum deflection of 1/50th of the span and 20 PSF wind uplift.
 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 3. Entire assemble, and installation shall be weathertight with fully welded corner joints on cover and curb.
 4. Operation and weathertightness shall not be unaffected by temperature.
 5. Thermally enhanced assembly:
 - a. R-12 minimum on both lid and curb.
 - b. Continuous gasketing at perimeter.

2.4 HATCH GUARDRAIL SYSTEM

- A. General:
1. Provide one such assembly at each hatch.
 2. Use appropriate model number variations according to hatch size and ladder position.
 3. Base Product: "Bil-Guard" by Bilco.
- B. Performance characteristics:
1. Integral color: High visibility safety yellow color.
 2. Hatch rail system shall attach to the cap flashing of the roof hatch without penetrating roofing material.
 3. Comply with OSHA 29 CFR 1910.23.
 4. Exceed OSHA strength requirements with a factor of safety of 2.
 5. UV- and corrosion-resistant construction with a 25-year warranty.
- C. Posts and Rails:
1. Reinforced, fire retardant, yellow fiberglass tubes.
 2. Treat with a UV inhibitor.
- D. Hardware:
1. Mounting brackets:
 - a. 1/4 IN thick hot dip galvanized steel.
 2. Hinges and post guides:
 - a. 6063T5 aluminum.
 3. Fasteners: Type 316 stainless steel.
- E. Gate:

1. Self-closing design of material matching balance of guardrail system.
2. Locate Gate on most safe and convenient side of each hatch (relative to ladder position) while avoiding roof obstructions.
 - a. Exception: Locations specifically indicated shall govern.

2.5 FABRICATION

- A. Fabricate from steel sheet and plate in shop, to sizes indicated; modify if necessary to comply with requirements.
- B. Where standard units are not available for sizes and types required, provide custom fabricated units.

PART 3 - EXECUTION

3.1 INSPECTION - GENERAL

- A. Verify acceptability of substrate for installation.
- B. Correct unsatisfactory conditions.

3.2 INSTALLATION

- A. Roof Hatches:
 1. Inspection:
 - a. Coordinate with decking and roofing.
 - b. Verify as-built conditions and coordinate with hatch manufacturer's details.
 - c. Verify that hatch installation will not disrupt other trades.
 - d. Report and correct defects prior to any installation.
 2. Installation:
 - a. Install wood blocking, specified in Division 06, as needed to insure that the curb has a minimum exposure of 8 IN of vertical surface above adjacent roof insulation for proper flashing.
 - b. Securely anchor units by bolting or welding, as appropriate.
 - c. Flash and counter flash to provide weathertight installation.
 - d. Touch up abraded areas with zinc rich paint.
- B. Hatch Guardrails:
 1. Inspection:
 - a. Verify as-built conditions and coordinate with manufacturer's hatch rail system details.
 - b. Verify that hatch rail system installation will not disrupt other trades.
 - c. Report and correct defects prior to any installation.
 2. Installation:
 - a. The hatch rail system shall be field assembled and installed per the manufacturer's instructions.
 - b. Permanently bolt guardrail assembly to vertical face of Roof Hatch curb.
 - c. Seal per manufacture's instructions to make penetrations watertight.

3.3 ADJUSTMENT

- A. After installation and before acceptance adjust to provide smooth, easy operation.

END OF SECTION

SECTION 07 76 16
PRECAST CONCRETE PAVER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Precast Concrete Paver System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer's qualifications:
 - 1. More than 5 years experience in the manufacture of pavers or pedestals of type specified as one of their principle products.
 - 2. At least 10 installations of paving systems with requirements similar to the products specified and conditions indicated.
- B. Design responsibility and criteria:
 - 1. Design in compliance with ACI 318-83.
 - 2. Design complete paver system including pavers, pedestals and protection board.
 - 3. Design system to withstand:
 - a. Dead loads plus superimposed loads.
 - b. Erection forces.
 - c. Temperature and shrinkage stresses.
 - d. Thermal movements.
 - e. Building movements.
 - f. Wind loads complying with Factory Mutual (FM) Class I-90 wind uplift resistance rating.
- C. Tolerances for manufacturing:
 - 1. Manufacture so paver faces exposed to view after erection comply with the following dimensional requirements.
 - a. Warpage: One corner out of plane of other three not more than 3/32 IN from nearest adjacent corner.
 - b. Bowing: Maximum 1/16 IN in 12 IN length or width.
 - c. Face edge lengths: Plus or minus 1/8 IN.
 - d. Thickness: Plus 1/8 IN, minus 3/32 IN.
 - e. Angular deviation of plane of side mold: 1/16 IN.
 - f. Deviation from square: 1/16 IN in any length.
- D. Tolerances for Installation of Pavers:
 - 1. Joints:
 - a. Variation in width: Plus 1/8 IN.
 - b. Taper in any length: 1/8 IN.
- E. Installer's qualifications:
 - 1. Manufacturer or installer which is approved by manufacturer:
 - a. More than 5 years experience in the installation of pavers and pedestals of the type specified.
 - b. At least 5 installations with requirements similar to the products specified and the conditions indicated.
 - 2. Superintendent for installation:
 - a. Approved by manufacturer:
 - b. Qualified to supervise installation.

- c. Supervised at least 3 installations with similar products and project conditions to those specified and Indicated.

1.3 SUBMITTALS

- A. Product Data:
 1. Manufacturer's standard catalogs for pavers, pedestals, and accessories.
 2. Manufacturer's installation instructions.
- B. Shop Drawings:
 1. Installation drawings indicating:
 - a. Layout showing patterns and colors.
 - b. Details for penetrations, perimeters and other edge conditions.
 2. Before fabrication: Three 24 IN x 24 IN samples of each color and/or texture for approval of appearance.
 3. Protection board.
- C. Samples:
- D. Project Information:
 1. Installer's qualifications.
- E. Contract Closeout Information:
 1. Maintenance data.
 2. Letter stating that extra material has been delivered.
- F. LEED Information:
 1. SS 7.2, Heat Island Effect – Roof: Manufacturer's product data indicating SRI (Solar Reflectance Index) of pavers.
 2. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 3. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Pavers:
 1. Base:
 - a. Wausau Tile, Inc.
 2. Optional:
 - a. Oldcastle, Westile Dix.
 - b. Sunny Brook Pressed Concrete Co.
 - c. Hanover Architectural Products, Inc.
- B. Pedestals:
 1. Base:
 - a. Wausau Tile, Inc.
 2. Optional:
 - a. Bison Screw Jack.
 - b. Envirospecs, Inc.
 - c. Sunny Brook Pressed Concrete Co.

- d. Hanover Architectural Products, Inc.
- C. Protection board:
- 1. Base: As recommended by roofing manufacturer.

2.2 MATERIALS

- A. Precast Concrete Pavers:
- 1. Solid precast concrete units complying with:
 - a. ASTM-C936, except without provisions for interlocking.
 - b. Precast/Pre-stressed Concrete Institute (PCI) MNL-117.
 - 2. Concrete Mix and properties:
 - a. Mix of clean water, Portland cement, coarse and fine aggregates, and pigments and other coloring agents to produce colors and textures specified.
 - b. Portland Cement: ASTM-C150, Type I or III, from one source.
 - c. Aggregates: ASTM-C33.
 - d. Pigments and other coloring agents:
 - e. Unfading mineral oxide.
 - f. Lime and alkali resistant.
 - 1) Limit type and amount used so as not to reduce quality of concrete.
 - g. 28-day strengths:
 - 1) Compressive: 7000 PSI.
 - 2) Flexural: 600 PSI.
 - h. Air entrainment: Between 6 and 8 percent including entrapped air.
 - i. Concrete weight: 145 to 150 LBS / CU FT.
 - j. SRI (Solar Reflectance Index) of Pavers should be no less than 29.
 - 3. Fabrication:
 - a. Face dimensions: 24 IN x 24 IN from centerline of joint to centerline of joint.
 - b. Thickness: 2 IN.
 - 4. Schedule of Colors/Textures
 - a. Field Color (PCP-1):
 - 1) Base Product/Series:
 - a) Wausau Type Six Cool Paver Series.
 - 2) Color: To be selected from manufacturer's standard choices.
 - 3) Location(s) used:
 - a) 2nd Floor terrace at northwest corner of building
 - b) 2nd Floor roof above north main entrance.
 - c) Where indicated on Drawings.
 - b. Provide special shapes and profiles indicated.
- B. Pedestals:
- 1. System of high density polyethylene plastic components providing:
 - a. Support for pavers, minimally one at each corner of each paver.
 - b. Leveling to within 3/16 IN.
 - c. Uniform open paver joint widths created by upright integral space ribs.
 - d. Cellular grid construction for through-drainage.
 - e. Capable of supporting the weight of pavers plus 100 PSF.
 - f. Height as indicated.
 - 2. Material properties:
 - a. Low temperature brittleness: ASTM-D746, minus 90 degF.
 - b. Resistant to ultra-violet: UV stabilized.
 - c. Hardness: ASTM-D2240, shore D65.
 - d. Softening point: ASTM-D1525, 265 C.
 - e. Weather-ability: Unaffected by freeze-thaw cycling, ozone and humidity, and not water absorbent.
- C. Protection board:
- 1. High strength extruded polystyrene board:

- a. ASTM-C578, Type V.
 - b. Compressive Strength: 100 PSI, with no more than 5 percent consolidation under load.
 - c. Density: 3 LBS / CU FT.
2. Thickness: Minimum recommended by roofing manufacturer and which will protect membrane from point loads at pedestals.

PART 3 - EXECUTION

3.1 INSTALLATION -GENERAL

- A. Perform installation under supervision of qualified superintendent, utilizing skilled and experienced personnel in the work.
- B. Erect system with pavers installed within specified tolerance limits, with nominal 3/16 IN wide joints.
- C. Install system to total thickness required for finished elevations indicated on Drawings.

3.2 PROTECTION BOARD

- A. Loose lay protection board over clean roof surface.
 1. Joint width: hand tight, not exceeding 3/16 IN.
 2. Place board without damaging roofing membrane.
- B. Cut protection board to coincide with paver edges at perimeter and protrusions through paving.
- C. Do not cover roof drains.
- D. Maintain flow patterns to prevent damming of water.

3.3 PEDESTALS

- A. Place pedestals on protection board to support corners of pavers and at intermediate locations where required for load distribution without damaging protection board or roofing membrane.
- B. Provide leveling plates at pedestals where necessary to produce indicated finished paving elevations.
- C. Provide partial pedestals at perimeter of paving and protrusions through paving, sized and shaped for full support of edge pavers without extending beyond paving edges.

3.4 PAVERS

- A. Set pavers with full support on pedestals in accordance with the manufacturer's instructions.
- B. Finished surface to comply with elevations indicated on Drawings to within 3/32 IN.
- C. Cut pavers only as necessary to fit paving perimeters and to accommodate penetrating items.
 1. Support partial pavers at 4 corners.
 2. Provide uniform cuts to result in cut edges of pavers matching cast uncut edges.
- D. After completion of setting, clean precast pavers thoroughly.
 1. Replaced stained or warped or other defective pavers.
 2. Leave pavers free of cleaning compound.

3.5 CLEANING

- A. Remove debris and stored materials.
- B. Sweep broom-clean.
- C. Replace damaged or stained items.
- D. Clean with solution recommended by manufacturer.

END OF SECTION

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SECTION 07 81 16
FIREPROOFING - PERFORMANCE BASED

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Fireproofing – Performance Based, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. SFRM: Spray-applied Fire-resistive Materials.
- B. Reference Standards:
 - 1. Fire resistance ratings for assemblies: UL Fire Resistance Directory.
 - 2. Fire resistance ratings for materials: UL Building Materials Directory.
- C. Field testing of fire resistant materials:
 - 1. ASTM-E605: Standard Test Methods for Thickness and Density of Spray Fire-Resistive Material (SFRM) Applied to Structural Members
 - 2. ASTM-E736: Cohesion/Adhesion of Spray Fire-Resistive Material (SFRM) Applied to Structural Members
- D. Design Criteria:
 - 1. Select UL approved fireproofing assemblies which meet or exceed the hourly fire resistive requirements indicated by table in Part 1.
 - a. For each density classification: Utilize materials that comply with Minimum Physical Properties indicated by table in Part 2.
 - b. Utilize formulations with minimum density classification according to location and exposure condition indicated by table in Part 3.
 - 2. Restraint classification of structural members: Restrained or unrestrained as defined by ASTM-E119.
 - 3. Utilize fireproofing systems which have been tested for use in proposed manner.
- E. Building Construction Parameters:
 - 1. Comply with following as locally adopted and amended:
 - a. International Building Code (IBC).
 - 1) Year: 2009.
 - 2) Building Use and Occupancy Classification: Business Group B.
 - 3) Construction Type: Type I-B.
 - b. NFPA 101 Life Safety Code.
 - 1) Year: 2009
 - 2) Building Use and Occupancy Classification: General (Ordinary Hazard) Industrial Occupancy.
 - c. NFPA 5000.
 - 1) Year: 2009.
 - 2) Construction Type: II-222

F. Minimum hourly fire resistance of building structural elements:

Minimum Fire Resistance Requirement – 2009 IBC; Construction Type I-B	
Building Element ¹	Minimum Hourly Fire Resistance Requirement
Primary Structural Frame ²	2-Hour
Primary Structural Frame ² supporting Roof only	1-Hour
Floor Decking and Secondary Structural members	2-Hour
Roof Decking and Secondary Structural members	1- Hour
Footnotes:	
1. As defined by Building Code.	
2. Columns and Girders/Beams/Trusses having direct connections to columns. Members not directly connected to columns are considered "secondary" members.	

- G. Determine where fireproofing is required to provide fire resistance protection of structural elements indicated by tabular values above.
1. At slab depressions, including regions sloped-to-drain:
 - a. Increase SFRM thickness as required to compensate for reduced overall slab thickness.
 - b. Extend 2 FT beyond perimeter of depressed region.
- H. Apply only when ambient temperatures are above 40 degF and will remain so during curing period.
1. Where temporary protection and heat is provided:
 - a. Maintain ambient temperatures at or above level indicated for 24 hours; before, during and for 24 hours after application.
- I. Ventilation: Ventilate spaces during and after application of spray applied fireproofing by natural means or forced-air circulation until fireproofing material dries thoroughly.
- J. Provide services of manufacturer's field service representative prior to, and during application for purposes of:
1. Checking surfaces which fireproofing is to be applied for proper preparation.
 2. Provide instructions and technical assistance.
- K. Do not install fireproofing until structure is sufficiently enclosed and roofing is installed to prevent damage to material.
- L. Coordination:
1. Sequence and coordinate application of spray applied fireproofing with other construction operations to comply with following requirements:
 - a. Provide temporary enclosures to confine spraying operations and to protect environment, and to prevent deterioration of fireproofing material due to exposure to weather or unfavorable ambient conditions of humidity, temperature or ventilation.
 2. Avoid exposure of fireproofing material to abrasion and other damage caused by construction operations after application.
 3. Do not apply concealed fireproofing until clips, hangers, supports, sleeves and other items penetrating fire protection are in place.
 4. Do not install ducts, piping and other items that would interfere with application of spray applied fireproofing until application is complete and approved by field testing.

5. Do not install enclosing or concealing construction until spray applied fireproofing has been installed, inspected and tested, and corrections have been made to defective applications.
6. Do not begin application of spray-applied fireproofing to underside of roof deck until roofing is complete, roof top units are installed, and construction roof traffic has ceased.

1.3 PRE-INSTALLATION MEETING

- A. Pre-installation meeting, directed by Contractor, prior to beginning of fireproofing work to discuss following:
 1. Contract Document requirements.
 2. Floor Plans and Framing Plans
 3. Significant Details.
 4. Manufacturer's specifications and details.
 5. UL requirements.
 6. Protection from damage by other trades.
- B. Attendance is recommended for:
 1. Contractor.
 2. Fireproofing installer's superintendent.
 3. Manufacturer's representative.
 4. Installers of interior and exterior walls.
 5. Mechanical installer.
 6. Plumbing installer.
 7. Deck installer.
 8. Other trades whose work may affect fireproofing system.
- C. Minimum two weeks prior to meeting forward pertinent information to Contractor for review.
 1. Installation drawings.
 2. Manufacturer product data.
 3. Cutsheets of applicable UL Designs.
 4. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.
- E. Objectives of pre-installation meeting to include:
 1. Review foreseeable methods and procedures related to fireproofing work.
 2. Tour representative areas where of fireproofing will be installed.
 3. Review fireproofing system requirements.
 4. Review required submittals both completed and yet to be completed.
 5. Review and finalize construction schedule related to fireproofing work and confirm availability of materials, installer's personnel, equipment and facilities required to make progress and avoid delays.
 6. Review required inspection, testing, certifying and material usage accounting procedures.
 7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary protection.
 - a. Review notification procedures for weather or non-working days.
 8. Record discussion of conference including decisions and agreements or disagreements reached.
 - a. If substantial disagreements exist at conclusion of conference, set date for reconvening meeting for resolution prior to installation.
- F. Commencement of work constitutes acceptance of all conditions affecting installation and performance of the fireproofing system.
- G. Furnish copy of record to each party who may be affected by fireproofing work, regardless of attendance, to Laboratory and Architect.
- H. Upon completion of project, manufacturer's representative to certify fireproofing system is properly installed in accordance with design requirements and manufacturer's instructions.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Data indicating physical properties of all proposed products.
 - 2. Schedule of sprayed fireproofing for specific structural elements, selected and prepared under direction of fireproofing manufacturer, indicating physical properties of all proposed products including:
 - a. Complete UL design data for each system selected.
 - b. Thickness of sprayed fireproofing for specific structural elements.
 - c. Densities of sprayed fireproofing and where used.
- B. Project Information:
 - 1. Test reports.
- C. Contract Closeout Information:
 - 1. Minutes from pre-installation meeting.
 - 2. Letter of Certification.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.
 - 4. EQ 4.2, Low-Emitting Materials – Paints and Coatings: Product data indicating VOC content of all paints and coatings.
 - a. Furnish quantities of all paints and coatings applied.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fireproofing:
 - 1. Base:
 - a. Grace Construction Products.
 - 2. Optional:
 - a. Carboline Company (Southwest, AD Fire Protection).
 - b. Isolatek International.
- B. For other products which show compliance with UL test requirements, submit request for substitution in accord with Section 00 26 00.

2.2 MATERIALS

- A. General:
 - 1. Reference Part 1 for hourly fire resistance requirements of various structural elements on project.
 - 2. Reference Part 3 for locations or conditions which may require densities listed in following Table.
 - a. Some density classifications may not be applicable to project.
- B. Provide products containing no detectable asbestos as determined in accordance with method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, and Polarized Light Microscopy.

1. Free from all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.

C. Products to be used shall comply with following minimum properties:

Minimum Physical Properties by Density Classification				
Property	Test Method	Standard Density	Medium Density	High Density
Binder Type	--	Gypsum or Portland Cement	Portland Cement ¹	Portland Cement
Dry Density	ASTM-E605	15 PCF	22 PCF	40 PCF
Bond Strength	ASTM-E736	200 PSF	500 PSF	6000 PSF
Compression (@ 10% Deformation)	ASTM-E761	1200 PSF	7200 PSF	50,000 PSF
Maximum Air Erosion	ASTM-E859	0.025 G/FT ² (Category A)	0.025 G/FT ² (Category A)	0.025 G/FT ² (Category A)
Corrosion	ASTM-E937	Does not contribute	Does not contribute	Does not contribute
Bond Impact	ASTM-E760	No cracking, spalling or delamination	No cracking, spalling or delamination	No cracking, spalling or delamination
Deflection	ASTM-E759			
Resistance to Mold Growth	ASTM-G21	No growth after 28 days	No growth	No growth
Combustibility	ASTM-E136	< 5 MJ/M ²	< 5 MJ/M ²	< 5 MJ/M ²
Flame Spread	ASTM-E84	< 25 (Class A)	< 25 (Class A)	< 25 (Class A)
Smoke Developed	ASTM-E84	< 450 (Class A)	< 450 (Class A)	< 450 (Class A)

Footnotes:

1. Gypsum-based products may be substituted where prolonged exposure to water is unlikely.

D. Base Products:

1. Standard Density: Monokote MK-6 or MK-6/HY or both by Grace Construction Products.
2. Medium Density:
 - a. For use in potentially wet areas: Monokote Z-106/HY by Grace Construction Products.
 - b. For use in non-wet areas: Monokote Z-106/G by Grace Construction Products.
3. High Density: Monokote Z-146 by Grace Construction Products.

2.3 AUXILIARY MATERIALS

A. General:

1. Provide auxiliary fire resistive materials that are compatible with spray applied cementitious fireproofing and substrates, and are approved by UL for use in approved UL design designations.

B. Adhesive:

1. As required for bonding spray applied fireproofing.
2. Products as approved by fireproofing manufacturer.
3. Adhesive VOC shall be no greater than 70 g/L.

C. Metal Lath:

1. Expanded metal lath fabricated from material, weight, configuration and finish required to comply with approved UL design designations and fireproofing manufacturer's written recommendations.
2. Include clips, lathing accessories, corner beads and other anchoring devices required to attach lath to substrates and to receive spray applied fireproofing.

D. Water:

1. Potable.
- E. Auxiliary Materials for used with Cellular Metal Decking:
 1. Include manufacturer's standard spatter coat or primer where required by UL Design or where recommended by manufacturer for optimal bond to substrate types; i.e., cellular decking.
 - a. Utilize product specifically formulated for use with cellular decking.
- F. Encapsulating Sealer:
 1. Sealer VOC shall be no greater than 100 g/L.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrates to accept application.
- B. Application constitutes acceptance of conditions and responsibility for performance.

3.2 PREPARATION

- A. Clean off materials which impair bond from surfaces to be fireproofed.
- B. Mark location of hangers, inserts, straps, anchors, supports, and similar items by other trades, that may be concealed by fireproofing to permit locating after fireproofing is applied.
- C. Schedule installation to allow time for installation of hangers, inserts, straps, anchorages, supports, and similar items by other trades.
- D. Prepare substrates, areas, and conditions for compliance with requirements affecting performance of work.
 1. Substrates shall be free of oil, grease, rolling compounds, incompatible primers, loose mill scale, soil and other foreign substances capable of impairing bond of fireproofing under conditions of normal use or fire exposure.
 2. Objects penetrating fire resistive material, including clips, hangers, supports, sleeves and similar items, shall be securely attached to substrates.
 3. Substrates shall not be obstructed by ducts, piping, equipment and other suspended construction that will interfere with application of spray applied fireproofing.
- E. Conduct tests in accordance with fireproofing manufacturer's written recommendations to verify substrates are free of substances capable of interfering with bond.
 1. Correct unsatisfactory conditions.
 2. Start of application constitutes acceptance of conditions and responsibility for performance.
- F. Cover other work subject to damage from fallout or overspray of fireproofing during application.
- G. For exposed fireproofing applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of spray-applied fireproofing.
 1. Remove minor projections.
 2. Fill voids that would telegraph through fireproofing after application.

3.3 INSTALLATION

- A. General:
 1. Install fireproofing of density types listed in this section for exposure locations and that provide fire resistance ratings indicated for components and assemblies.
 2. Thickness: Minimum average thickness indicated for UL design designation, but not less than 3/8 IN.
 3. Apply in accordance with manufacturer and UL requirements.

4. Provide preparation, primers, adhesives, materials, taping and sealers necessary to provide required fire resistance ratings.
 5. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey and spray on fireproofing material, as applicable to particular conditions of installation and as required to achieve fire resistance ratings indicated.
 - a. Apply spray applied fireproofing materials that are identical to products tested and substantiated by test reports with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, rolling and water overspray.
- B. Where required to achieve fire resistance rating or rating recommended in writing by fireproofing manufacturer, coat metal deck substrates with adhesive before applying fireproofing material.
- C. Extend fire resistive material in full thickness over entire area of each substrate to be protected.
 1. Install body of fire resistive covering in single course, unless otherwise recommended in writing by SFRM manufacturer,
- D. Connections of Dissimilar Structural Elements:
 1. Definition: Where structural elements are joined to other, often different type, of structural elements having a lesser SFRM protection requirement.
 2. Overlap the lesser priority structural element with superior SFRM thickness required by the higher priority element.
 3. Minimum Width of Overlap: As required in design system published by UL or similar testing agency, but not less than 6 IN.
- E. Install metal lath if required to comply with fire resistance ratings or fireproofing manufacturer's written recommendations for conditions of exposure and intended use.
 1. Securely attach lath to substrate in position required for support and reinforcement of fireproofing material.
 2. Use anchorage devices of type recommended in writing by fireproofing manufacturer.
 3. Attach lathing accessories where required for secure attachment to substrate.
- F. Spray apply fireproofing to maximum extent possible.
 1. Apply fireproofing in thicknesses and densities not less than required for fire resistance ratings for each condition; however, apply in greater thicknesses and densities if indicated.
 2. Following the spraying operations in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
 3. Where sealers are used, apply products that are tinted for differentiation from spray applied fireproofing.
- G. Exposed fireproofing:
 1. Apply fireproofing in thicknesses and densities not less than required for fire resistance ratings for each condition; however, apply in greater thicknesses and densities if indicated.
 2. Finish:
 - a. Following the spraying operations in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
 - b. In addition, provide uniform even spray textured finish up to 8 FT above finished floor.
 - 1) Roll flat surfaces with damp paint roller to remove drippings and excessive roughness of applied exposed fireproofing.
 - 2) Locations: Provide rolled flat fireproofing surfaces in Mechanical Rooms, Elevator Machine Rooms, Emergency Generator Rooms, Electrical Switchgear Rooms, and rooms containing similar equipment items.
 - 3) Exposed fireproofing higher than 8 FT above finished floor is not required to have rolled flat surface finish using paint roller.

- H. Cure exposed fireproofing in accordance with manufacturer’s written recommendations to prevent premature drying.
- I. Fireproof accessory items such as but not limited to X-bracing, struts, outriggers, and similar items.
- J. At elevated slab depressions, including regions sloped to drain:
 - 1. Apply additional fireproofing as required to compensate for reduced overall floor slab thickness.
 - 2. Extend 2 FT beyond perimeter of depressed region.

3.4 SCHEDULE OF DENSITIES REQUIRED BY EXPOSURE CONDITIONS

- A. Determine appropriate density required for project conditions based on following:
 - 1. Some conditions may not apply to subject project.

Minimum Density Required according to Location/Exposure Condition					
Location/Exposure Condition of Structural Members			Minimum Density Required		
			Standard Density	Medium Density	High Density
INTERIOR	Concealed	Members that are fully concealed behind permanent Wall or Soffit Construction. (Refer to “Exposed” if <u>any portion</u> of a member is not concealed).	S		
	Exposed	Members that are entirely above ordinary (non-walkable) Suspended Ceilings.	S ^{1,2}		
		Members where any exposed portion occurs within interstitial spaces above walk-able Ceiling Systems (i.e. Laboratories, Clean Rooms, etc).		M ¹	
		Members where any exposed portion occurs within Elevator Shafts, Air Shafts or Air Plenum Space.		M ¹	
		Members where any exposed portion occurs within 8 FT of Floors, Stair Landings, Treads or similar walking surface.		M ¹	
		Members in Parking Structures, Mechanical Rooms and Storage Rooms where <u>any portion</u> is exposed.			H
		Members where any portion is protected with Deluge Fire Suppression System.			H
EXTERIOR	Concealed	Members that are fully concealed by weathertight construction.	S		
		Members that are fully concealed by exterior soffit construction.	S		
		Members that are concealed by construction that is not completely weathertight.			H
	Exposed	Members that are exposed to weather (permanently).			H

General Notes:

Use above Table to select appropriate minimum density, based on the Location/Exposure criteria which best describes the condition. It is acceptable to provide material of a higher density.

Where a member (or various portions of a member) fits multiple Location/Exposure categories: Utilize the highest density product from among the potential choices; Apply that density to the “entire” member.

Refer to Part 2 for minimum properties of each density classification.

Refer to Part 1 for hourly fire resistance requirements of various structural elements on this project.

Footnotes:

1. Ensure the use of Portland Cement-based formulas where prolonged exposure to water or high-humidity (>70% RH) is likely.

2. Upgrade to “Medium” where above-ceiling space is designed as an Air Plenum.

3.5 FIELD QUALITY CONTROL

- A. General:
 - 1. Thickness and Density Testing:
 - a. Test Standard: ASTM-E605; “Thickness and Density of Spray Fire Resistive Materials (SFRM) Applied to Structural Members”.
 - b. Minimum Test Frequency: In accordance with building Code, as locally adopted; however, not less than frequency prescribed by ASTM-E605.
 - 2. Bond Adhesion and Cohesion Testing:
 - a. Test Standard: ASTM-E736: “Cohesion and Adhesion of Spray Fire Resistive Materials (SFRM’s) Applied to Structural Members”.
 - b. Minimum Test Frequency: In accordance with building Code, as locally adopted; however, not less than frequency prescribed by ASTM-E736.
- B. Testing paid for by Laboratory:
 - 1. Contractor provide fireproofing systems schedule, prepared by spray fireproofing manufacturer, to independent testing laboratory.
 - 2. Contractor arrange with independent testing laboratory to take samples and perform required tests.
 - a. Contact laboratory, solicit proposals, and provide additional information about laboratory Laboratory requires.
 - b. Provide information to Laboratory for review.
 - c. Obtain written Laboratory approval of selected laboratory.
 - d. If laboratory is unacceptable, investigate others until Laboratory accepts a testing laboratory.
 - 3. Test in field, per ASTM standards indicated to ensure conformance with applicable building Code and UL requirements for thickness, density and bond strength.
 - a. Should test fail, take additional tests until extent of defective area has been determined.
 - b. Repair or remove and replace defective material and retest until requirements are met.
 - c. Cost of initial tests paid by Laboratory.
 - d. Retesting due to test failure paid by Contractor.

3.6 CLEANING, PROTECTION AND REPAIR

- A. Cleaning:
 - 1. Immediately after completing fireproofing in each containable area, remove material overspray and fallout from surfaces of other construction.
 - 2. Clean exposed surfaces to remove soiling.
- B. Protection:
 - 1. Protect fireproofing from damage or deterioration resulting from construction operations.
 - a. Protect in accordance with manufacturer’s and installer’s recommendations that shall result in fireproofing without damage or deterioration.
 - 2. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 3. Protect fireproofing material as installation of other construction materials proceeds.
- C. Repair:
 - 1. Patch damaged fireproofing and patch areas where fireproofing has been removed by other construction operations.
 - 2. Repair or replace work that has been damaged.
 - 3. Where areas of fireproofing become damaged, after work of other trades has progressed sufficiently; patch, repair and restore fireproofing to complete UL required condition at no additional expense to Laboratory.
 - 4. Mechanical and Electrical Division installers are responsible for repair required as a result of their work.

5. Fireproofing installer repair responsibility for damaged fireproofing is limited to correction of damage caused by trades other than Mechanical and Electrical Divisions.

END OF SECTION

SECTION 07 81 23
INTERIOR INTUMESCENT FIREPROOFING (IFP)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Interior Intumescent Fireproofing (IFP), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Reference standards:
 - 1. Warnock Hersey - Certification Listings.
 - 2. UL Building Materials Directory.
 - 3. Association of the Wall and Ceiling Industries - International (AWCI):
 - a. AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide.
 - 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. Steel Structures Painting Council (SSPC) PA-2.
- B. Intumescent fireproofing and protective finish topcoat shall be products from or approved by a single manufacturer.
 - 1. Primers and other undercoat materials shall be produced or recommended by the manufacturer of intumescent fireproofing for compatibility of the total system.
- C. Applicator qualifications:
 - 1. Approved by manufacturer of intumescent fireproofing for application,
 - 2. Personnel trained and qualified in techniques and procedures for proper application.
 - 3. Minimum of 5 years successful experience in application of intumescent fireproofing.
- D. Regulatory requirements:
 - 1. Where more stringent than the specified requirements, conform to applicable codes for the following ratings:
 - a. Flame spread.
 - b. Fuel contributed.
 - c. Smoke developed.
 - d. Volatile organic compound (VOC).
 - e. Fire resistance.
- E. Design Criteria:
 - 1. Select UL approved fireproofing assemblies which meet or exceed hourly fire resistive requirements indicated by table in Part 1.
 - 2. Utilize materials in compliance with minimum physical properties indicated by table in Part 2.
 - 3. Restraint classification of structural members: Restrained or unrestrained as defined by ASTM-E119.
 - 4. Utilize fireproofing systems which have been tested for use in proposed manner.
- F. Building Construction Parameters:
 - 1. Comply with following as locally adopted and amended:
 - a. International Building Code (IBC).

- 1) Year: 2009.
- 2) Building Use and Occupancy Classification: Business Group B.
- 3) Construction Type: Type I-B.
- b. NFPA 101 Life Safety Code
 - 1) Year: 2009.
 - 2) Building Use and Occupancy Classification: General (Ordinary Hazard) Industrial Occupancy.
- c. NFPA 5000.
 - 1) Year: 2009.
 - 2) Construction Type: Type II (222).

G. Minimum hourly fire resistance of building structural elements:

Minimum Fire Resistance Requirement – 2009 IBC; Construction Type I-B	
Building Element ¹	Minimum Hourly Fire Resistance Requirement
Primary Structural Frame ²	2-Hour
Primary Structural Frame ² supporting Roof only	1-Hour
Floor Decking and Secondary Structural members	2-Hour
Roof Decking and Secondary Structural members	1-Hour
Footnotes: 1. As defined by Building Code. 2. Columns and Girders/Beams/Trusses having direct connections to columns. Members not directly connected to columns are considered "secondary" members.	

- H. Determine where fireproofing is required to provide fire resistance protection of structural elements indicated by tabular values above.
- I. Provide services of manufacturer's field service representative prior to, and during application for purposes of:
 - 1. Checking surfaces which fireproofing is to be applied for proper preparation.
 - 2. Provide instructions and technical assistance.
- J. Do not install fireproofing until structure is sufficiently enclosed and roofing is installed to prevent damage to material.
- K. Sequence and coordinate application of intumescent fireproofing with other construction operations to comply with following requirements:
 - 1. Prevent deterioration of fireproofing material due to exposure to weather or unfavorable ambient conditions of humidity, temperature or ventilation.
- L. Avoid exposure of fireproofing material to moisture, abrasion and other damage caused by construction operations after application.
- M. Upon completion of project, manufacturer's representative to certify fireproofing system is properly installed in accordance with design requirements and manufacturer's instructions.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Data indicating physical properties of all proposed products.

2. Schedule of intumescent fireproofing for specific structural elements, selected and prepared under direction of fireproofing manufacturer, indicating physical properties of all proposed products including:
 - a. Complete Warnock Hersey or UL design data for each system selected.
 - b. Dry film thickness of intumescent fireproofing for specific structural elements.
- B. Samples:
1. Topcoat colors for selection by Architect.
- C. Project Information:
1. Test reports.
- D. Contract Closeout Information:
1. Letter of Certification.
- E. LEED Information:
1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 2. EQ 4.2, Low-Emitting Materials – Paints and Coatings: Manufacturer’s product data indicating VOC content of curing agents applied inside building envelope.
 - a. Provide quantities of each coatings applied inside building envelope.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Thin-film Intumescent Fireproof (IFP) Coating System:
1. Base:
 - a. Carboline (A/D Firefilm, Nullifire).
 2. Optional:
 - a. Albi Manufacturing.
 - b. Isolatek International (Cafco).
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
1. Products formulated for use on interior, non-wet, areas.
 2. Refer to Section 07 81 24 for intumescent products to be used on Exterior and wet areas.
 3. Product/Systems Testing. Any of the following:
 - a. Listed by ULI and bearing the UL label.
 - b. Listed by ITS/WH and bearing ITS/WH label.
 - c. Listed by FM and bearing the FM mark.
 4. Fire resistance:
 - a. 2-hour unless otherwise noted.
 5. Final finish: Smooth to slight orange peel.
- B. Primer:
1. Select from manufacturer's list of approved primers, and according to substrate type, quality and conditions.
- C. Intumescent Coating:
1. Water-based, thin film, intumescent fireproofing.
 2. Base Product: AD FireFilm III by Carboline, AD Fire Protection Systems.

3. Physical Properties:

Physical Properties - Thin Film Intumescent Coating for Interior Applications			
Minimum Criteria	Test Method	Required Value	
		Metric	IP
Hardness (Shore D)		72 Durometer	
Surface Burning Characteristics	ASTM-E84	Flame: 0-20; Smoke: 0-50; (Class A)	
Density	--	1.42 G/CC	11.9 LB/GAL
Dry Weight	--	1.87 KG/M2 @ 1.1mm DFT	0.38 LBS/FT2 @ 42 mil DFT
Cohesion/ Adhesion	ASTM-E736	862 KPA	18,000 LBS/FT ²
Compressive Strength (@ 10% deformation)	ASTM-E761	5.2 MPA	109,008 LBS/FT ²
		1.2 kg-M @ 1.6mm	103 IN-LBS @ 65mm
VOC	ASTM-D3960	20 G/L	0.17 LB/GAL

D. Basecoat, where required by listed assembly:

1. Compatible, non-intumescent product for use where required by specific conditions.
2. Base Product: AD BaseCoat by Carboline, AD Fire Protection Systems.
3. Basecoat shall have a VOC content no greater than 250 g/L.

E. Reinforcing Mesh, where required by listed assembly:

1. Alkali-resistant, self-adhesive fiberglass mesh/cloth.
2. Weight: 4.5 OZ/YD².
3. Base Product: Glass Cloth/Mesh by Carboline (AD Fire Protection Systems).

F. Protective Topcoat:

1. Single-component, low-VOC, silicone alkyd coating.
2. Gloss rating:
 - a. Semi-gloss.
3. Color:
 - a. Selected by Architect
4. Base Product: AD ColorCoat by Carboline, AD Fire Protection Systems.
5. Top coat shall have a VOC content no greater than 250 g/L.

2.3 MIXING

- A. Obtain materials which are pre-blended from the factory.
- B. Mix gently in order to minimize introduction of air to the product.
- C. Do not add water or solvent at site.

2.4 SPRAY APPLICATION EQUIPMENT

- A. Spray equipment:
 1. Capacity, pressure, tip sizes: Comply with manufacturer's requirements.
- B. Dry film thickness gage to provide measurements complying with SSPC PA-2.
- C. Air movement and dehumidification equipment approved by manufacturer of intumescent fireproofing.
- D. Roller or brush applications will not be accepted unless approved by Architect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrates to accept application.
 - 1. Correct defects, including but not limited to solvent based identification markings on steel and weld flashes.
 - 2. Verify ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is complete.
- B. Verify that substrate surfaces are ready to receive work.
 - 1. Clean steel surfaces in accordance with Commercial Blast Cleaning SSPC-SP6/NACE No.3.
 - 2. Grind welds smooth.
 - 3. Remove existing coatings including non-compatible primers, paints, coatings and mill scale.
- C. Verify clips, hangers, sleeves and similar devices have been attached.
- D. Prime steel surfaces with primer approved by intumescent product manufacturer.
- E. Start of application constitutes acceptance of conditions and responsibility for performance.

3.2 APPLICATION

- A. General:
 - 1. Comply with manufacturer's product data, including technical bulletins, product catalogue, application instructions and product markings for installation.
 - 2. Apply spray method, utilizing brush or roller application only when spray application is not practical.
 - a. Comply with manufacturer's requirements for application equipment, capacities, application pressures, tip sizes, etc. in order to achieve a smooth finish with minimum of orange peel texture.
 - 3. Allow materials and substrate steel to reach same temperature before application, by storing unopened containers in area of application.
 - 4. Apply in accordance with manufacturer's and Warnock Hersey or UL requirements.
- B. Primer:
 - 1. Prime steel surfaces with compatible primer approved by manufacturer of intumescent fireproofing to ensure adhesion.
- C. Basecoat where required by listed assemblies:
 - 1. Apply Basecoat at a maximum rate of 60 mils wet per coat.
 - 2. Where embedded glass cloth is required:
 - a. Embed mesh per manufacturer's instructions and per listing agency.
 - b. Apply skim coats of fireproofing over glass cloth as required to achieve a smooth, final finish.
- D. Intumescent Fireproofing:
 - 1. Thoroughly mix products and apply in sufficient thickness to achieve fire resistance rating indicated.
 - 2. Keep container covered to the maximum extent during application.
 - 3. Limit each coat of application to not more than 30 mils wet thickness (or approximately 23 mils DFT).
- E. Topcoat:
 - 1. Do not apply Topcoat until it has been determined that the required dry film thickness (DFT) of the intumescent and basecoat layers has been met.
 - 2. Allow intumescent and basecoats to dry at least 24 hours before applying topcoat.
 - 3. Thickness for uniform opaque coverage ranging from 2 to 4 mil final dry film thickness.
 - 4. Do not apply successive coats until previous coat is dry to touch.

3.3 PATCHING

- A. Where areas of fireproofing become damaged, after work under other sections has progressed sufficiently, patch, repair and restore fireproofing to complete required condition.

3.4 FIELD QUALITY CONTROL

- A. General:
 - 1. Independent testing laboratory shall take samples and conduct required tests.
 - a. Arrange work schedule in coordination with testing agency to allow for testing of each incremental area of work followed by any corrections required prior to proceeding with next area of work.
 - b. Testing laboratory will perform tests at random for each area or work.
 - c. Provide agreed advance notice to testing agency for each incremental test.
 - 2. Test in accordance with ASTM-E84 and ASTM-E119 requirements to ensure conformance with applicable UL requirements for thickness, density and adhesion.
 - 3. Should any test fail, additional test will be taken until extent of defective area has been determined.
 - 4. Repair or remove and replace defective material for retesting until requirements are met.
 - 5. Measure final dry film thickness of intumescent fireproofing with dry film thickness gage.
 - a. Comply with specified field quality control requirements.
 - b. For method of thickness determination refer to AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide.
- B. Test Frequency:
 - 1. Comply with more stringent criteria from following;
 - a. Building Code as locally adopted.
 - b. AWCI and or ASTM requirements.
- C. Testing Paid for By Laboratory:
 - 1. Contractor to arrange with independent testing laboratory to take samples and conduct required tests.
 - a. Contact laboratory, solicit quotes, provide additional information about laboratory Laboratory requires.
 - b. Provide information to Laboratory for review.
 - c. Obtain written Laboratory approval of selected laboratory.
 - d. If laboratory is unacceptable, investigate others until Laboratory accepts one.
 - 2. Test in field, per ASTM standards indicated to ensure conformance with applicable building Code and UL requirements for thickness, density and bond strength.
 - 3. Should test fail, take additional tests until extent of defective area has been determined.
 - 4. Repair or remove and replace defective material and retest until requirements are met.
 - 5. Cost of initial tests paid by Laboratory.
 - 6. Retesting due to test failure paid by Contractor.

3.5 CLEANING AND PROTECTION

- A. Remove fireproofing materials from surfaces not specifically required to be fireproofed, and remove excess material, over-spray, dropping and debris.
- B. Protect fireproofed surfaces form moisture, dust, dirt and damaged cold temperature.

END OF SECTION

SECTION 07 81 24
EXTERIOR INTUMESCENT FIREPROOFING (IFP)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Exterior Intumescent Fireproofing (IFP), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Thin film intumescent products to be used on interior: Specified in Section 07 81 23.
- B. Reference standards:
 - 1. Warnock Hersey - Certification Listings.
 - 2. UL Building Materials Directory.
 - 3. Association of the Wall and Ceiling Industries - International (AWCI):
 - a. AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide.
 - 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. Steel Structures Painting Council (SSPC) PA-2.
- C. Intumescent fireproofing and protective finish topcoat shall be products from or approved by a single manufacturer.
 - 1. Primers and other undercoat materials shall be produced or recommended by the manufacturer of intumescent fireproofing for compatibility of the total system.
- D. Applicator qualifications:
 - 1. Approved by manufacturer of intumescent fireproofing for application,
 - 2. Personnel trained and qualified in techniques and procedures for proper application.
 - 3. Minimum of 5 years successful experience in application of intumescent fireproofing.
- E. Regulatory requirements:
 - 1. Where more stringent than the specified requirements, conform to applicable codes for the following ratings:
 - a. Flame spread.
 - b. Fuel contributed.
 - c. Smoke developed.
 - d. Volatile organic compound (VOC).
 - e. Fire resistance.
- F. Design Criteria:
 - 1. Select UL approved fireproofing assemblies which meet or exceed hourly fire resistive requirements indicated by table in Part 1.
 - 2. Utilize material in compliance with minimum physical properties indicated by table in Part 2.
 - 3. Restraint classification of structural members: Restrained or unrestrained as defined by ASTM-E119.
 - 4. Utilize fireproofing systems which have been tested for use in proposed manner.
- G. Building Construction Parameters:
 - 1. Comply with following as locally adopted and amended:
 - a. International Building Code (IBC).

- b. Year: 2009.
- c. Building Use and Occupancy Classification: B.
- d. Construction Type: I-B.

H. Minimum hourly fire resistance of building structural elements:

Minimum Fire Resistance Requirement – 2009 IBC; Construction Type I-B	
Building Element ¹	Minimum Hourly Fire Resistance Requirement
Primary Structural Frame ²	2-Hour
Primary Structural Frame ² supporting Roof only	1-Hour
Floor Decking and Secondary Structural members	2-Hour
Roof Decking and Secondary Structural members	1- Hour
Footnotes: 1. As defined by Building Code. 2. Columns and Girders/Beams/Trusses having direct connections to columns. Members not directly connected to columns are considered "secondary" members.	

- I. Determine where fireproofing is required to provide fire resistance protection of structural elements indicated by tabular values above.
- J. Provide services of manufacturer’s field service representative prior to, and during application for purposes of:
 - 1. Checking surfaces which fireproofing is to be applied for proper preparation.
 - 2. Provide instructions and technical assistance.
- K. Sequence and coordinate application of intumescent fireproofing with other construction operations.
- L. Avoid exposure of fireproofing material to damage caused by construction operations after application.

1.3 PRE-INSTALLATION MEETING

- A. Pre-installation meeting, directed by Contractor, prior to beginning of fireproofing work to discuss following:
 - 1. Contract Document requirements.
 - 2. Floor Plans and Framing Plans
 - 3. Significant Details.
 - 4. Manufacturer’s specifications and details.
 - 5. UL requirements.
 - 6. Protection from damage by other trades.
- B. Attendance is recommended for:
 - 1. Contractor.
 - 2. Fireproofing installer’s superintendent.
 - 3. Manufacturer’s representative.
 - 4. Installers of interior and exterior walls.
 - 5. Mechanical installer.
 - 6. Plumbing installer.
 - 7. Other trades whose work may affect fireproofing system.
- C. Minimum two weeks prior to meeting forward pertinent information to Contractor for review.

1. Installation drawings.
 2. Manufacturer product data.
 3. Cutsheets of applicable UL Designs.
 4. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.
- E. Objectives of pre-installation meeting to include:
1. Review foreseeable methods and procedures related to fireproofing work.
 2. Tour representative areas where of fireproofing will be installed.
 3. Review fireproofing system requirements.
 4. Review required submittals both completed and yet to be completed.
 5. Review and finalize construction schedule related to fireproofing work and confirm availability of materials, installer's personnel, equipment and facilities required to make progress and avoid delays.
 6. Review required inspection, testing, certifying and material usage accounting procedures.
 7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary protection.
 - a. Review notification procedures for weather or non-working days.
 8. Record discussion of conference including decisions and agreements or disagreements reached.
 - a. If substantial disagreements exist at conclusion of conference, set date for reconvening meeting for resolution prior to installation.
- F. Commencement of work constitutes acceptance of all conditions affecting installation and performance of the fireproofing system.
- G. Furnish copy of record to each party who may be affected by fireproofing work, regardless of attendance, to Owner and Architect.
- H. Upon completion of project, manufacturer's representative to certify fireproofing system is properly installed in accordance with design requirements and manufacturer's instructions.
- I. Design Criteria:
1. General:
 - a. Provide fireproofing systems which, when applied to and combined with structural steel systems produce complete fire resistant assemblies meeting or exceeding requirements specified.
 - b. Use systems approved by authorities having jurisdiction.
 - c. Provide fireproofing materials that bear classification markings by Warnock Hersey or UL testing agency using ASTM Standards and having a factory inspection service subject to approval of authorities having jurisdiction.
 - 1) Products shall be manufactured under testing agency's follow-up program.

1.4 SUBMITTALS

- A. Product Data:
1. Data indicating physical properties of all proposed products.
 2. Schedule of intumescent fireproofing for specific structural elements, selected and prepared under direction of fireproofing manufacturer, indicating physical properties of all proposed products including:
 - a. Complete Warnock Hersey or UL design data for each system selected.
 - b. Dry film thickness of intumescent fireproofing for specific structural elements.
- B. Samples:
1. Topcoat colors for selection by Architect.
- C. Project Information:
1. Test reports.

- D. Contract Closeout Information:
 - 1. Minutes from pre-installation meeting.
 - 2. Letter of Certification.
- E. LEED Information:
 - 1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.5 WARRANTY

- A. Fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering. Reinstall or repair such defects or failures for a period of 1 year.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Thin-film Intumescent Fireproof (IPF) Coating System:
 - 1. Base:
 - a. Carboline (A/D Firefilm, Nullifire).
 - 2. Optional:
 - a. Albi Manufacturing.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 - 1. Thin film intumescent products formulated for use on Exterior areas which will be permanently exposed to weather.
 - 2. Refer to Section 07 81 23 for intumescent products to be used on Interior areas.
 - 3. Product(s)/Systems(s) Testing (any of the following):
 - a. Listed by ULI and bearing the UL label.
 - b. Listed by ITS/WH and bearing ITS/WH label.
 - c. Listed by FM and bearing the FM mark.
 - 4. Fire Resistance:
 - a. 2-hour (unless otherwise noted).
 - 5. Final finish: Smooth to slight orange peel.
- B. Primer:
 - 1. Select from manufacturer's list of approved primers, and according to substrate type, quality and conditions.
 - 2. Base Product: "Nullifire S605" by Carboline, or other material type recommended or approved by fireproofing manufacturer.
- C. Reinforcing Mesh (where required by listed assembly):
 - 1. Alkali-resistant, self-adhesive fiberglass mesh/cloth.
 - 2. Same manufacturer as fireproofing or manufacturer approved product.
- D. Intumescent Coating:
 - 1. Single component, solvent based, factory mixed, asbestos free, intumescent material blended for uniform texture; conforming to the following requirements:

Physical Properties - Thin Film Intumescent Coating (Exterior)			
Minimum Criteria	Test Method	Required Value	
		Metric	IP
Surface Burning Characteristics	ASTM-E84	Flame: 0-20; Smoke: 0-50; (Class A)	
Dry Density	ASTM-E605	1089 G/L	68 LBS/FT ³
Bond Strength	ASTM-D4541	2.6 MPa	375 PSI
Compressive Strength	ASTM-D695	14.5 MPa	2,100 PSI
Impact Resistance	ASTM-D256	9.6 G/mm of notch	0.54 FT-LBS per IN of notch

2. Finish Color: Pale Green.
 3. Base Product: "Nullifire S605" by Carboline.
- E. Reinforcing Mesh (where required by listed assembly):
1. Alkali-resistant, self-adhesive glass mesh/cloth.
 2. Weight: 6.0 OZ/YD².
 3. Base Product: "Glass Cloth/Mesh" by A/D Fire Protection Systems.
- F. Paint:
1. Specified in Section 09 91 13, Exterior Painting.

2.3 SPRAY APPLICATION EQUIPMENT

- A. Spray equipment:
1. Capacity, pressure, tip sizes: Comply with manufacturer's requirements.
- B. Dry film thickness gage to provide measurements complying with SSPC PA-2.
- C. Air movement and dehumidification equipment approved by manufacturer of intumescent fireproofing.
- D. Roller or brush applications will not be accepted unless approved by Architect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrates to accept application.
1. Correct defects, including but not limited to solvent based identification markings on steel and weld flashes.
 2. Verify ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is complete.
 3. Verify that voids and cracks in substrate are filled, and projections are removed where fireproofing is exposed to view as a finish material.
- B. Examine surfaces to receive work of this Section and report any defects which may affect the work of this section.
- C. Verify that substrate surfaces are ready to receive work.
1. Weld flashes should be ground smooth prior to commencement of application.
 2. Confirm compatibility of surfaces to receive fireproofing materials.
 - a. Prime Steel surfaces with a compatible primer, approved by intumescent product manufacturer.
- D. Verify that clips, hangers, sleeves and similar devices have been attached.
- E. Verify substrate and workspace temperature and humidity conditions are in accordance with manufacturer's recommendations.
- F. Start of application constitutes acceptance of conditions and responsibility for performance.

3.2 SEQUENCING AND SCHEDULING

- A. Schedule application of intumescent fireproofing as last as practical in sequence of construction.
 - 1. In each area, apply fireproofing.
 - a. Before painting and installation of finished flooring.
 - b. After concrete applications.
 - c. In conjunction with placement of hanger tabs, mechanical component hangers and similar devices connected to members to be coated.
 - 2. Where less than 36 IN clear working access will be available after steel surfaces are installed, apply fireproofing to inaccessible surfaces prior to erection of steel members.

3.3 PREPARATION

- A. Work in accordance with SSPC guidelines SSPC-SP-1, SSPC-SP-2, SSPC-SP-3, and/or SSPC-SP-6 as recommended, and appropriate to prepare substrate.
- B. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.
- C. Adjacent Surfaces Protection:
 - 1. Protect adjacent surfaces, work areas, finish surfaces and equipment from over-spray/damage during product application.
- D. Remove existing coatings including non-compatible primers, paints, coatings and mill scale.
- E. Seal penetrations or open ended fireproofing termination by chamfering at a 45-degree angle and sealing with high heat silicone sealant.
- F. Install reinforcement over structural members as indicated on Drawings, or U.L. Fire Resistance Directory Listings.
- G. Weld flashes shall be ground smooth prior to commencement of application.

3.4 APPLICATION

- A. General:
 - 1. Comply with manufacturer's product data, including technical bulletins, product catalogue, application instructions and product markings for installation.
 - 2. Apply spray method, utilizing brush or roller application only when spray application is not practical.
 - a. Comply with manufacturer's requirements for application equipment, capacities, application pressures, tip sizes, etc. in order to achieve a smooth finish with minimum of "orange peel" texture.
 - 3. Allow materials and substrate steel to reach same temperature before application, by storing unopened containers in area of application.
 - 4. Apply in accordance with manufacturer's and Warnock Hersey or UL requirements.
- B. Primer:
 - 1. Prime steel surfaces with compatible primer approved by manufacturer of intumescent fireproofing to ensure sufficient adhesion.
 - 2. Apply primer according to primer manufacturer's recommendations.
 - 3. Provide primer "cut-back" 3 IN inches for bolted connections and 12 IN for welded connections.
- C. Intumescent Fireproofing:
 - 1. Thoroughly mix products and apply in sufficient thickness to achieve fire resistance rating(s) indicated.
 - 2. Apply fireproofing in accordance with manufacturer's instructions.
 - a. Do not apply to surfaces which would prohibit proper adhesions.
 - 3. Keep container covered to the maximum extent during application.

- a. Use circulation feature on spray equipment.
- b. Purge hoses with water before interruptions of spray process.
- c. Mix frequently when applying with roller or brush.
4. Apply fireproofing in sufficient thickness to achieve rating(s) indicated, with as many passes necessary to cover with monolithic blanket of uniform hardness, density and texture.
 - a. Spray, and roll smooth the finished surface.
 - b. Do not apply successive coats until previous coat is dry to touch.
5. Measure final DFT of intumescent fireproofing with dry film thickness gage.
 - a. Comply with specified field quality control requirements.
 - b. For method of thickness determination refer to *AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide*.

3.5 PATCHING

- A. Where areas of fireproofing become damaged, after work under other sections has progressed sufficiently, patch, repair and restore fireproofing to complete required condition.

3.6 FIELD QUALITY CONTROL

- A. General:
 1. Independent testing laboratory shall take samples and conduct required tests.
 - a. Arrange work schedule in coordination with testing agency to allow for testing of each incremental area of work followed by any corrections required prior to proceeding with next area of work.
 - b. Testing laboratory will perform tests at random for each area or work.
 - c. Provide agreed advance notice to testing agency for each incremental test.
 2. Test shall be in accordance with ASTM-E84 and ASTM-E119 requirements to ensure conformance with applicable UL requirements for thickness, density and adhesion.
 3. Should any test fail, additional test will be taken until extent of defective area has been determined.
 4. Repair or remove and replace defective material for retesting until requirements are met.
- B. Test Frequency:
 1. Comply with more stringent criteria from the following;
 - a. Building Code as locally adopted.
 - b. AWCI and or ASTM requirements.
- C. Testing Paid for By Owner:
 1. Contractor to arrange with independent testing laboratory to take samples and conduct required tests.
 - a. Contact laboratory, solicit quotes, provide additional information about laboratory Owner requires.
 - b. Provide information to Owner for review.
 - c. Obtain written Owner approval of selected laboratory.
 - d. If laboratory is unacceptable, investigate others until Owner accepts one.
 2. Test in field, per ASTM standards indicated to ensure conformance with applicable building Code and UL requirements for thickness, density and bond strength.
 3. Should test fail, take additional tests until extent of defective area has been determined.
 4. Repair or remove and replace defective material and retest until requirements are met.
 5. Cost of initial tests paid by Owner.
 6. Retesting due to test failure paid by Contractor.

3.7 CLEANING AND PROTECTION

- A. Remove fireproofing materials from surfaces not specifically required to be fireproofed, and remove excess material, over-spray, dropping and debris.

- B. Protect fireproofed surfaces form moisture, dust, dirt and damaged cold temperature.
- C. Protect floor areas from this Work by completely covering with tarps or 4 mil polyethylene sheets.
- D. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting.
- E. Close off and seal ductwork in areas where fireproofing is being applied.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Firestopping, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Section includes Through Penetration Firestop Systems for penetrations through the following fire-resistance rated assemblies, including both blank openings and openings containing penetrating items:
 - 1. Floor assemblies.
 - 2. Roof assemblies.
 - 3. Walls and partitions.
 - 4. Fire-rated smoke barriers.
 - 5. Construction enclosing compartmentalized areas.
 - 6. Existing, fire and smoke-rated elements.
 - 7. Not included: Walls and smoke partitions not fire rated and do not require through penetration firestop assemblies.
- B. Section includes fire resistive joint assemblies for linear voids where fire-rated floor, roof, or wall assemblies abut one another, including the following types of joints:
 - 1. Top of wall at intersection with overhead roof or floor structure:
 - a. Fire-rated walls: Agency-approved assemblies employing materials specified in this section.
 - b. Non-fire rated partitions, including smoke partitions: Seal to structure with acoustical sealant specified in Section 09 29 00.
 - 2. Interior Fire Rated Expansion Joints: Specified in Section 07 95 13.
 - 3. Exterior Fire Rated Expansion Joints: Specified in Section 07 95 14.
 - 4.
- C. Provide firestop systems that comply with following requirements:
 - 1. Firestopping tests, performed by a qualified, testing and inspection agency.
 - a. Qualified testing and inspection agency: UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to local authorities having jurisdiction.
 - 2. Firestop system products bear classification marking of qualified testing and inspection agency.
 - 3. Applications that exist for which no tested system is available through a manufacturer: Provide engineering judgment derived from similar UL system designs or other tests approved by local authorities having jurisdiction, prior to installation.
 - a. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.
- D. Installer Qualifications:
 - 1. Certified, licensed or approved by firestopping manufacturer trained to install firestop products per specified requirements.
 - 2. Licensed by the State or local authority, where applicable.
 - 3. Shown to have successfully completed not less than five (5) comparable scale projects.

- E. Single-source: Obtain firestop system for each type of penetration and construction condition indicated from a single manufacturer.
- F. Fire Test Requirements:
1. Underwriters Laboratories, Inc. (UL):
 - a. UL 1479, Fire Tests of Through Penetration Firestops.
 - b. UL 2079, Tests for Fire Resistance of Building Joint Systems.
 - c. UL 263, Fire Tests of Building Construction and Materials.
 - d. UL 723, Surface Burning Characteristics of Building Materials.
 2. American Society of Testing and Materials (ASTM):
 - a. ASTM-E814, Fire Tests of Through Penetration Fire Stops.
 - b. ASTM-E1966, Test Method for Fire Resistive Joint Systems.
 - c. ASTM-E119, Fire Tests of Building Construction and Materials.
 - d. ASTM-E84, Surface Burning Characteristics of Building Materials.
 - e. ASTM-E1399, Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
 - f. ASTM-E2174, Standard Practice for On-site Inspection of Installed Fire Stops.
 - g. ASTM-E-2393, Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- G. References:
1. Underwriters Laboratories (UL) Fire Resistance Directory:
 - a. Through Penetration Firestop Systems (XHEZ).
 - b. Joint Systems (XHBN).
 - c. Fill, Void or Cavity Materials (XHHW).
 - d. Firestop Devices (XHJI).
 - e. Forming Materials (XHKU).
 - f. Wall Opening Protective Materials (CLIV).
 2. Building Code as locally adopted and amended.
 3. National Fire Protection Association (NFPA):
 - a. NFPA 101: Life Safety Code.
 - b. NFPA 70: National Electrical Code.
 4. Firestop Contractors International Association (FCIA):
 - a. Manual of Practice.
 5. International Firestop Council (IFC):
 - a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments, April 2001.
 - b. Ref. 2 Inspectors Field Pocket Guide.
- H. Identification Labels for Firestop Assemblies:
1. Install labels which identify each firestop installation, including but not limited to: fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any wall required to have protected openings.
 2. Such identification shall be above any decorative ceiling and in concealed spaces.
 3. Permanently identify with signs or stenciling in a manner acceptable to the authority having jurisdiction.
 4. Repeat at intervals not exceeding 30 feet (914 mm) measured horizontally along each side of wall or partition.
 5. Suggested text for fire and smoke barriers: FIRE AND SMOKE BARRIER – PROTECT ALL OPENINGS, in lettering not less than 0.5 inch (12.7 mm) in height.
- I. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- J. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings.
1. Provide products appropriately tested for the thickness and type of insulation utilized.

- K. Cabling where frequent cable moves, add-ons, and changes are likely to occur in future:
 1. Where cable trays are used to convey such cabling: Utilize re-enterable products (e.g. removable intumescent pillows) specifically designed for retrofit.
 2. Where cable trays are not used: Utilize fire-rated cable pathway devices. Where not practical, re-enterable products specifically designed for retrofit may also be used.
- L. Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall.
 1. Systems within the UL Fire Resistance Directory that meet this criterion are identified with the words “Chase Wall Optional.”
- M. Fire Resistive Joint Sealants:
 1. Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.
 2. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM-E1399, ASTM-E1966 or UL 2079.
 3. Provide fire-resistive joint systems subjected to an air leakage test conducted in accordance with Standard, UL 2079 with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.
- N. Provide smoke wall containment systems subjected to an air leakage test conducted in accordance with Standard, UL 1479 with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

1.3 SUBMITTALS

- A. Product Data:
 1. Product information of utilized products.
- B. Shop Drawings:
 1. Complete details of each proposed system.
- C. Project Information:
 1. UL reports with illustration of systems and system numbers.
 2. Firestop contractor to supply firestop tracking process documentation to include the following:
 - a. Firestop affidavit.
 - b. Firestop system photographs.
 - c. Installation log.
 - d. Firestop systems.
 - e. IFC guidelines for Engineering Judgments.
 - f. Building Code sections relevant to firestop systems.
- D. Project Closeout:
 1. Interactive Life Safety Plan to include all firestop systems installed with links to firestop systems.
 2. Electronic file of all project documentation provided to General Contractor (Construction Manager), Architect, Inspector and Laboratory.
- E. LEED Information:
 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2: Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Firestopping Materials:
 1. Base:
 - a. Hilti.
 2. Optional:
 - a. Specified Technologies, Inc (STI).
 - b. 3M.
 - c. Tremco.
- B. Forming Materials:
 1. Base:
 - a. Thermafiber.
 2. Optional:
 - a. Roxul Inc.
 - b. IIG Minwool.
 - c. Rock Wool Manufacturing.
- C. Other manufacturers, that have UL-listed systems for conditions indicated, desiring approval comply with Section 00 26 00.
 1. See systems Volume 2 of UL Building Materials Directory.
 2. Systems not UL-listed for conditions will not be accepted.

2.2 FIRESTOPPING – GENERAL REQUIREMENTS

- A. Contractor is responsible to select systems approved for conditions encountered and when installed maintain required fire separations.
- B. Provide firestopping systems and materials compatible with one another, with substrates forming openings, and with penetrating items, under conditions of service and application.
- C. Provide components for each firestopping system needed to install fill materials.
- D. Materials shall be provided by a single firestopping products manufacturer as far as possible.
- E. All materials used shall be specific items named in UL assemblies being installed.
- F. All materials must be UL, or approved third party testing agency, listed for designated fire resistance rated systems, and acceptable to authorities having jurisdiction.
- G. Use only products tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, void width, movement capabilities, and fire-rating involved for each instance.

2.3 MATERIALS

- A. Latex Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.
 1. Voc content of sealants shall be no greater than 250 g/L.
- B. Through Penetration Firestop Systems:

1. Base Products: FS-ONE, and CP606 by Hilti.
 2. Optional Products:
 - a. SpecSeal Series SSS and LCI Intumescent Sealants, SpecSeal Series LC Endothermic Sealant, and SpecSeal Series AS Elastomeric Spray by STI.
 - b. IC15WB+, CP25WB+, FireDam 150+ by 3M.
 3. VOC content of sealants shall be no greater than 250 g/L.
- C. Fire-resistive Joints:
1. Base Products: CP601, CP604, CP606 and CP672 by Hilti.
 2. Optional Products:
 - a. SpecSeal Series ES and AS Elastomeric Sealants by STI.
 - b. FireDam 150+, Fire Barrier 1000NS, Fire Barrier 1003SL, Fire Barrier 2000NS, FireDam Spray 200 by 3M.
 3. Sealant VOC content no greater than 2500 g/L.
- D. Firestop Devices:
1. Factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
 2. Base Products: CP643N, and CP644 by Hilti.
 3. Optional Product:
 - a. SpecSeal Series SSC and LLC Firestop Collars by STI.
 - b. Fire Barrier Ultra Plastic Pipe Device by 3M.
- E. Intumescent Pads, Wall Opening Protective Materials:
1. Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes, medical gas outlets, and other items recessed in face of fire rated walls.
 2. Base Products: CP617 by Hilti.
 3. Optional Products:
 - a. SpecSeal Series SSP Firestop Putty Pads and SpecSeal Series EP PowerShield Insert Pads by STI.
 - b. Interam Ultra GS Wrap Strip, 3M Fire Barrier Moldable Putty+ pads, 3M Fire Barrier Moldable Putty Stix by 3M.
- F. Fire-rated Cable Pathways:
1. Usage:
 - a. Cables passing through fire-rated floors or walls shall pass through fire-rated cable pathway devices made from an intumescent material that adjusts automatically to cable additions or subtractions.
 2. Product Description and Requirements:
 - a. Pathway device modules comprised of steel raceway and intumescent foam pads.
 - b. F-Rating equal to the rating of barrier the device penetrates.
 - c. Pathway devices shall be capable of allowing a 0 to 100 percent fill of cables.
 - d. Size to accommodate quantity and size of electrical wires and data cables indicated plus 100 percent expansion.
 - e. Provide wire devices with steel wall plates allowing for single or multiple devices ganged together.
 3. Base Product: CP653 Speed Sleeve by Hilti.
 4. Optional Products:
 - a. EZ-PATH Fire Rated Pathway by STI.
 - b. 3M Fire Barrier Pass-Through Devices by 3M.
- G. Firestop Putty:
1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
 2. Base Product: CP648E, and CP648S by Hilti.
 3. Optional Products:
 - a. SpecSeal Series SSP Firestop Putty by STI.
 - b. 3M Fire Barrier Moldable Putty+ pads.

- c. 3M Fire Barrier Moldable Putty Stix.
- H. Wrap Strips:
- 1. Single component intumescent elastomeric strips faced on both sides with a plastic film:
 - 2. Base Products: CP645 and CP648 by Hilti.
 - 3. Optional Products:
 - a. SpecSeal Series RED Wrap Strip and SpecSeal Series BLU Wrap Strip by STI.
 - b. Interam Ultra GS Wrap Strip, 3M Fire Barrier FS 195+ Wrap Strip by 3M.
- I. Firestop Pillows:
- 1. Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.
 - 2. Base Product: CP657 FireBlock by Hilti.
 - 3. Optional Products:
 - a. SpecSeal Series SSB Firestop Pillows by STI.
 - b. 3M Fire Barrier Pillows, 3M Fire Barrier Self-Locking Pillows, by 3M.
- J. Mortar:
- 1. Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
 - 2. Base Product: CP637 by Hilti.
 - 3. Optional Products:
 - a. SpecSeal Series SSM Firestop Mortar by STI.
 - b. 3M Fire Barrier Mortar by 3M.
- K. Silicone Sealants:
- 1. Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces pourable or nonsag or vertical surface nonsag.
 - 2. Base Products: CP601S by Hilti.
 - 3. Optional Products:
 - a. Pensil 300 Silicone Sealant and Pensil 300 SL Self-Leveling Silicone Sealant by STI.
 - b. Fire Barrier 3000WT Water Tight Silicone, 3M Fire Barrier 1000NS and 1003 SL Silicone, 3M Fire Barrier 2000+, Fire Barrier 2000NS by 3M.
 - 4. Sealant VOC content shall be no greater than 250 g/L.
- L. Foam:
- 1. Multi-component, silicone-based, liquid elastomer.
 - 2. Base Product: CP620 by Hilti.
 - 3. Optional Products:
 - a. Pensil 200 Silicone Foam by STI.
 - b. 3M Fire Barrier 2001 RTV Foam by 3M.
- M. Forming Materials:
- 1. Materials listed as components in laboratory-approved designs.
 - 2. Mineral Wool:
 - a. Base Products: Type SAF by Thermafiber or similar products specifically named as components in laboratory-approved designs.
 - b. Optional Product: 3M Fire Barrier Packing Material PM4 by 3M.
- N. Perimeter Fire Containment: Specified in Section 07 84 53.

2.4 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. General:
- 1. Schedules below identify requirements for acceptable through penetration firestop systems based on barrier type, fire-resistive rating, and penetrant type. Each system must comply with building code and fire code as locally adopted and amended.
 - 2. Requirements for single-membrane penetrations and through penetration firestops are identical. Unless otherwise noted, penetrants which pass through a single membrane, shall be treated the same as if it passed through the entire fire-resistive assembly.

3. Select each firestop system based on actual field conditions, including penetration type, shape, size, quantities and physical position within opening.
 4. Refer to Plans for indication of the required ratings of fire-resistive wall, floor, and roof assemblies.
 5. Indicated ratings are minimum and may be exceeded.
 6. Firestop Assemblies at Fire-Rated Walls:
 - a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
 - b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.
 - c. Smoke Barrier: In addition to (F) Rating, (L) Rating of maximum 5 CFM per SF.
 - d. Non-rated walls and Smoke-Partitions with no fire-resistive requirement: Assembly with (L) rating.
 7. Firestop assemblies at fire-rated floors and roofs:
 - a. Minimum Fire (F) and Temperature (T) Ratings of Firestop assemblies used in floors or roof shall equal hourly rating of floor or roof being penetrated, but not less than 1-HR.
 - 1) Exception 1: The T-rating may equal zero when portion of penetration, above or below floor, is contained within a wall.
 - 2) Exception 2: Firestops are not required for floor penetrations within a 2-hour rated shaft enclosure.
- B. Voids in wall with no penetrations:
1. Fill with approved through penetration firestopping system.
 2. Contractors option: Patch void in wall with like construction.
- C. Penetrating Ducts with Dampers:
1. Utilize only firestop materials which are included in damper's classification.
 2. Do not install firestop systems that hamper performance of fire dampers.
- D. Cable Trays and similar devices:
1. Provide re-enterable products specifically designed for removal and re-installation at openings within walls and floors designed to accommodate voice, data and video cabling.
- E. Electrical and Electrical Devices recessed in to face of rated walls:
1. Items included: Switches, receptacles, J-boxes, medical gas outlets, and similar items recessed in face of fire rated walls.
 2. Where such devices are placed on opposite sides of wall, and are less than 24 IN apart measured horizontally, install intumescent pads over back of devices in approved manner or maintain continuity of rated barrier within wall cavity surrounding recessed item.

2.5 FIRE-RESISTIVE JOINT ASSEMBLIES – GENERAL

- A. General:
1. Where joint will be exposed to the elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM-C920.
- B. Head-of-Wall Assemblies:
1. General:
 - a. Use at top of fire-rated and smoke barrier walls and partitions where they abut floor and roof structures above.
 - b. Select systems with D designation, rated for dynamic movement capability.
 - c. Select systems that can accommodate deflection of structure above.
 - d. Maximum Leakage for Fire-resistive Joints in Smoke Barriers: 5 CFM or less per linear foot as tested in accordance with UL 2079.
 - e. Sound-control walls and smoke partitions which are not stipulated to include fire-resistance rating. Seal with acoustical sealant, specified in Section 09 29 00.
 2. Minimum F and T ratings:
 - a. The minimum fire rating for firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.

- b. The minimum temperature rating of firestop assemblies in walls may equal zero.
- 3. Acceptable Systems:
 - a. Metal stud and drywall partitions: Select system from UL HW-D-0000 Series.
 - b. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examination of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Install firestop systems in accordance with manufacturer's instructions and conditions of testing and classification as specified in UL or other acceptable third-party testing agency listing.
 - 2. Penetrations through fire-resistive floor assemblies shall be sealed with firestop system providing minimum Class 1 W-rating as tested in accordance with UL 1479 and ensure air and water resistant seal.
 - 3. Protect materials from damage on surfaces subjected to traffic.
- B. Identification Labels.
 - 1. General:
 - a. Identify each Firestop Assembly as defined in Quality Assurance.
 - b. Do not locate identification labels, tags, or both, on finished surfaces or where exposed to view by public.

3.3 FIELD QUALITY CONTROL

- A. Maintain areas of work accessible until inspection by authorities having jurisdiction.
- B. Where deficiencies are found, repair or replace assemblies to comply with requirements.

3.4 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean surfaces adjacent to sealed openings free of excess materials and soiling as work progresses.
- C. Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION

SECTION 07 84 53
PERIMETER FIRE CONTAINMENT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Perimeter Fire Containment Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. This section includes Perimeter Fire Containment Systems consisting of a floor with an hourly fire-resistance rating, an exterior wall assembly with no hourly fire-resistance rating, and fill and forming materials installed between floor and curtain wall for preventing spread of fire vertically in buildings.
- B. Installer Qualifications:
 - 1. Certified, licensed or approved by firestopping manufacturer as having necessary training to install firestop products per specified requirements.
 - 2. Licensed by the State or local authority, where applicable.
 - 3. Shown to have successfully completed not less than five (5) comparable scale projects.
- C. Obtain Perimeter Fire Containment Systems for each slab edge and wall condition indicated from a single manufacturer.
- D. Contractor is responsible to select a system, or combination of systems which, when installed, will maintain required fire separation between building elements.
- E. Coordinate construction of Perimeter Fire Containment Systems with installation of adjacent materials to ensure items are installed in accordance with specified requirements.
- F. Provide Perimeter Fire Containment Systems that comply with following requirements:
 - 1. Firestopping tests, performed by a qualified, testing and inspection agency.
 - a. Qualified testing and inspection agency: OPL or agency performing testing and follow-up inspection services for firestop systems acceptable to local authorities having jurisdiction.
 - 2. Perimeter fire containment system products bear classification marking of qualified testing and inspection agency.
 - 3. Applications for which no tested system is available through a manufacturer: Provide engineering judgment derived from similar UL system designs, OPL system designs or tests approved by local authorities having jurisdiction, prior to installation.
 - a. Engineering judgment drawings must follow requirements set forth by International Firestop Council.
- G. Fire Test Requirements:
 - 1. Fire test investigation to be conducted on Intermediate-Scale, Multi-Story Test Apparatus (ISMA structure) using an assimilation of the methods and conditions of acceptance contained within following ASTM and UL standards:
 - 2. Underwriters Laboratories, Inc. (UL):
 - a. UL 263, Fire Tests of Building Construction and Materials.
 - b. UL 723, Surface Burning Characteristics of Building Materials.
 - 3. American Society of Testing and Materials (ASTM):
 - a. ASTM-E119, Fire Tests of Building Construction and Materials.
 - b. ASTM-E84, Surface Burning Characteristics of Building Materials.

- c. ASTM-E2307, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-Story Test Apparatus.
- 4. National Fire Protection Association (NFPA):
 - a. NFPA-285, Tests for Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multi-Story Test Apparatus.

H. References:

- 1. Underwriters Laboratories (UL) Fire Resistance Directory:
 - a. Perimeter Fire Containment Systems (XHDG)
 - b. Fill, Void or Cavity Materials (XHHW)
 - c. Forming Materials (XHKU)
 - d. Curtain Wall Insulation (XHGU)
- 2. Building Code as locally adopted and amended.
- 3. National Fire Protection Association (NFPA):
 - a. NFPA 101: Life Safety Code.
- 4. Omega Point Laboratories, Inc. (OPL) Listed Products Directory, Volume II.
 - a. Fire Resistant Joint Systems.

I. Identification labels for perimeter fire containment assemblies:

- 1. Install labels which identify each firestop installation.
- 2. Label shall be pre-printed by supplier and include the following:
 - a. Name of supplier of firestop system.
 - b. UL design number, OPL design number or approved testing agency.
 - c. Date of installation.
 - d. Name of firestopping installer.
- 3. Identification labels may be in the form of self-adhering stickers, tie-on identification tags, or combination of both as appropriate for permanent identification of firestop assemblies.

J. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, ponding water or other forms of moisture characteristic during and after construction.

K. Provide sealants sufficiently flexible to accommodate movement such as thermal expansion, inter-story differential building sway and other normal building movement without damage to the seal.

L. Provide perimeter fire containment systems subjected to an air leakage test conducted in accordance with Standard, UL 2079 with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

1.3 SUBMITTALS

A. Product Data:

- 1. Product information of utilized products..

B. Shop Drawings:

- 1. Complete details of each proposed system at floors and roof.

C. Project information:

- 1. UL reports with illustration of systems and system numbers.
- 2. Firestop contractor to supply firestop tracking process documentation to include the following:
 - a. Firestop affidavit.
 - b. Firestop system photographs.
 - c. Installation log.
 - d. Firestop systems.
 - e. IFC guidelines for Engineering Judgments.

- f. Building Code sections relevant to firestop systems.
- D. Project Closeout:
- 1. Interactive Life Safety Plan to include all firestop systems installed with links to firestop systems.
 - 2. Electronic file of all project documentation provided to General Contractor (Construction Manager), Architect, Inspector and Laboratory.
- E. LEED Information:
- 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2: Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Adhesives: Manufacturers' product data for construction adhesive including VOC content.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Perimeter Fire Containment System:
- 1. Base:
 - a. Specified Technologies, Inc (STI).
 - 2. Optional:
 - a. 3M.
 - b. Hilti.
 - c. Tremco.
 - 3. Other manufacturers, that have UL-listed systems for fire resistant joint systems and conditions indicated, desiring approval comply with Section 00 26 00.
 - a. See UL Building Materials Directory XHDG systems in Volume 2.
 - b. See Omega Point Laboratories, Inc. (OPL) Listed Products Directory, Volume II.

2.2 MATERIALS

- A. Mineral Wool Insulation:
- 1. Base:
 - a. Thermafiber.
 - 2. Optional:
 - a. 3M.
 - b. Industrial Insulations Group.
 - c. Owens-Corning.
 - d. Roxul, Inc.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.3 PERIMETER FIRE CONTAINMENT SYSTEM

- A. General:
- 1. Provide compatible perimeter fire containment system products, forming material, fillers, sealants and other items, to substrates forming openings, under conditions of service and application.
 - 2. Provide components for each perimeter fire containment system needed to install fill materials.

3. Utilize products tested for specific fire-resistance-rated construction to non-rated construction conditions conforming to construction assembly type, linear void width, and fire-rating involved for each separate instance.
- A. Silicone Spray Sealants:
 1. Non re-emulsifying single component silicone/urethane formulation.
 - a. Base Product: SpecSeal Fast Tack Firestop Spray by STI.
 2. Optional Products: Comply with Section 00 26 00.
 - B. Silicone Sealants:
 1. One part non-sag or self-leveling silicone elastomeric firestopping sealant.
 2. Base Product: SIL300 Silicone Firestop Sealant by STI.
 3. Optional Products:
 - a. SpecSeal 2000 Silicone Sealant by 3M.
 - b. Tremstop Silicone, Fyre-Sil by Tremco.
 - c. CP 601S by Hilti.
 4. Sealants shall have a VOC content no greater than 250 g/L.
 - C. Latex Spray Sealants:
 1. Non re-emulsifying single component latex formulation.
 - a. Base Product: SpecSeal Series AS Elastomeric Spray by STI.
 2. Optional Products:
 - a. FireDam Spray 200 by 3M.
 - b. TremStop Acrylic Spray by Tremco.
 - c. CP 672 Speed Spray by Hilti.
 - D. Mineral Wool Insulation:
 1. Faced or unfaced batts or blankets used for exterior curtain walls with the capacity to contribute to fire-resistance of assembly.
 2. Approved component of the UL-system proposed.
 3. Base Product: FireSpan or FireSpan SS by Thermafiber.
 4. Optional Products:
 - a. Type RHT-80 Insulation by Roxul Inc.
 - b. CW-8 Curtain Wall Insulation by Owens-Corning.
 - E. Safing Insulation:
 1. Board or sheet products used as forming materials in edge of slab openings with capacity to provide a degree of fire resistance required when used with approved fill material.
 2. Base Product: Type SAF by Thermafiber.
 3. Optional Products:
 - a. SAF Mineral Wool by Roxul Inc.
 - b. Safing Insulation by Owens Corning.
 - F. Spandrel Insulation at non-fire rated conditions: Specified in Section 07 21 00.
 - G. Through Penetration Firestop Systems: Specified in Section 07 84 00.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to completion.
- B. Prepare surfaces to which firestop materials will be applied in accordance with manufacturer's recommendations and free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit adhesion.

- C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PERIMETER FIRE CONTAINMENT SYSTEM INSTALLATION

- A. General:
 - 1. Install perimeter fire containment systems in accordance with performance requirements and in accordance with the conditions of testing and classification as specified in the published design.
 - 2. Install in accordance with manufacturer's instructions for installation of perimeter fire containment system products.
- B. Seal all edge of slab openings to ensure an air and water resistant seal.
- C. Curtain wall insulation that is an integral component of the perimeter fire containment system shall be installed in accordance with the conditions of testing and classification as specified.
 - 1. Upgrade as required where additional R-value is needed to comply with thermal insulation requirements as specified in Section 07 21 00, Building Insulation.
- D. Install safing insulation with the grain oriented vertically to maintain effective compression between edge of floor assembly and curtain wall.

3.3 FIELD QUALITY CONTROL

- A. Identification Labels:
 - 1. Identify each Perimeter Fire Containment System as defined in Quality Assurance.
 - 2. Do not locate identification labels, tags or both on finished surfaces or exposed to public view.
- B. Keep areas of work accessible until inspection by authorities having jurisdiction.
- C. Laboratory shall engage qualified independent inspection agency to inspect firestop system in accordance with ASTM E2393, Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- D. Where deficiencies are found, repair or replace systems so they comply with requirements.

3.4 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed openings to be free of excess materials and soiling as work progresses.
- C. Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION

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SECTION 07 92 13
EXTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Definition:
 - 1. Words “calk” and “caulking” mean sealant work.
- B. Seal joints which would otherwise permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Work included: Provide sealants as follows:
 - 1. Flashing reglets and retainers.
 - 2. Exterior wall joints.
 - 3. Masonry control joints, and between masonry and other materials.
 - 4. Isolation joints.
 - 5. Joints between paving or sidewalks and building.
 - 6. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
 - 7. Perimeters door and window frames, louvers, grilles, etc.
 - 8. Joints between dissimilar materials, to provide visually acceptable closures.
 - 9. Solidly bed thresholds at exterior doors.
 - 10. Other joints where caulking, or sealant is indicated.
 - 11. Joints where Pre-molded Compressible Sealants is indicated.
- D. Related materials specified elsewhere:
 - 1. Interior Joint Sealants: See Section 07 92 16.
 - 2. Firestopping: Specified in Section 07 84 00.
 - 3. Acoustical Sealant: Specified in Section 09 29 00.

1.2 QUALITY ASSURANCE

- A. Sealant materials:
 - 1. Sealant specification: ASTM-C920 Type S or M, Grade-NS, minimum Class-25.
 - 2. Sealant testing: ASTM-C510; ASTM-C711; ASTM-C719 Class-25, Grade-N; ASTM-C792; ASTM-C793; ASTM-C910.
 - 3. Sealant use: ASTM-C1193.
 - 4. Pre-molded Compressible Sealants: ASTM-C509.
 - 5. Installer approved by manufacturer.
 - 6. Testing of installed joint sealants per Section 07 92 13.
- B. Staining Potential (of adjacent materials caused by sealants):
 - 1. Pre-test proposed sealants where sealants are used with any of the following materials:
 - a. Marble, sandstone, limestone, granite, and other types of stonework.
 - b. Architectural Precast.
 - c. Brick Masonry.
 - 2. Test Method: ASTM-C1248.
 - 3. Historical testing using same materials and cataloged by sealant manufacturer will be considered acceptable.
 - 4. Where testing suggests that staining potential exists: Reselect sealant and retest.
 - 5. Certify that staining potential has been evaluated.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Sealant Schedule with the following information:
 - a. Generally describe locations requiring sealants (i.e. Brick to Alum Window).
 - b. List type of sealant to be used, and name of product proposed.
 - c. Include a blank column on schedule for colors.
 - d. Upon review, Architect to complete Color Column.
- B. Samples:
 - 1. Cured sample of each color for color selection (submit with Sealant Schedule).
 - 2. Colors for Pre-molded Compressible Sealant.
- C. Project Information:
 - 1. Certificate that furnished sealants meet minimum VOC requirements as specified by the California South Coast Air Quality Management District Rule.
- D. Test data.
- E. Contract Closeout Information:
 - 1. Warranty.
- F. LEED Information:
 - 1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 JOB CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degF.
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

1.5 WARRANTY

- A. Provide written warranty that sealant work will remain free of defects for a period of 2 years:
 - 1. Failure of watertightness or air tightness constitutes defect.
 - 2. Remove defective work and materials and replace with new work and materials.
 - 3. Repair other work damaged as a result of defective sealant work at no additional expense to Laboratory.
 - 4. Warranty signed by Installer and/or Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Silicone sealants:

- a. Base:
 - 1) Tremco.
 - 2) Dow Corning.
 - b. Optional:
 - 1) Pecora.
 - 2) GE Silicones.
 - 3) Sonneborn/ChemRex.
 - 4) Bondaflex Technologies.
2. Polyurethane sealants:
- a. Base:
 - 1) Tremco.
 - b. Optional:
 - 1) Pecora.
 - 2) Sonneborn/ChemRex.
 - 3) Sika.
 - 4) Bondaflex Technologies.
3. Other Sealants:
- a. Base: As indicated.
4. Pre-molded Compressible Sealant:
- a. Base:
 - 1) Emseal.
 - b. Optional:
 - 1) Dayton Superior, Polytite.
 - 2) Construction Specialties, (C/S).
 - 3) MM Systems.
5. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 SEALANTS - GENERAL

- A. General:
 - 1. Provide colors matching materials being sealed.
 - 2. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
 - 3. Use non-sag sealant in vertical and horizontal joints.
 - 4. Use self-leveling in horizontal joints.
 - 5. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
 - 6. Use only compatible materials.
 - 7. Obtain sealants from manufacturers who will provide manufacturers' field service representatives at project site for purpose of advising and instructing installers.
 - a. Provide such services, at no expense to Laboratory.
- B. Silicone Sealants:
 - 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws.
- C. Polyurethane Sealants:
 - 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws.
- D. Other Sealant Types:
 - 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws.

2.3 MISCELLANEOUS MATERIALS

- A. Joint cleaner, primer, bond breaker:
 - 1. As recommended by sealant manufacturer.

- B. Backer Rod:
1. Rod stock of polyethylene, polyethylene jacketed polyurethane foam, or other flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer to:
 - a. Control joint depth.
 - b. Break bond of sealant at bottom of joint.
 - c. Provide proper shape of sealant.

2.4 PRE-MOLDED COMPRESSIBLE SEALANT

- A. Pre-molded Compressible Sealant (pre-finished):
1. Description: Foam backing: Multiple layers of acrylic-impregnated, expanding foam sealant and closed-cell (EVA) foam.
 2. Weather Facing: Low-modulus silicone with bellows profile.
 3. Movement capability: +/-25% movement (50% total).
 4. Material to be sized appropriately for joint widths indicated.
 5. Base Product: "ColorSeal" by Emseal.
- B. Compressible Backer:
1. Description: Foam backing with multiple layers of acrylic-impregnated, expanding foam sealant and closed-cell (EVA) foam.
 2. Provide behind conventional backer-rod and sealant where indicated.
 3. Provide behind directly-applied liquid sealant where indicated.
 4. Movement capability: +/-25% movement (50%).
 5. Material to be sized appropriately for joint widths indicated.
 6. Base Product: "Backerseal" by Emseal.
- C. Accessory Items:
1. Installation Adhesive: As recommended by manufacturer of compressible sealants and backers.
 2. Comply with VOC limits as required by local laws.

PART 3 - EXECUTION

3.1 SEALANT USAGE GUIDELINES

Guide to Sealant Types - EXTERIOR				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
Exterior (General)	Cast in Place Concrete	Multi-part Polyurethane, chemically curing, epoxidized	Tremco "Dymeric 240"	Exception: Use "Dymonic" where used as bedding sealant for frames, sills, thresholds etc.
	Brick and Concrete Masonry			
	Portland Cement Plaster			
	Hollow Metal Door and Window Perimeters			
	Aluminum Composite Panels (ACM) and Metal Column Covers	Silicone	Tremco "Spectrem 1" or "Spectrem 3"	--
	Joints in materials with high coefficients of linear expansion			
	Weatherseals of Aluminum Window Frames (including perimeter joints)			
	Precast Concrete Panels	Silicone	Tremco "Spectrem 1"	--
	EIFS Systems			
Stone Work	Silicone	Tremco "Spectrem 3"	Exception: Pre-test for staining potential per ASTM-C1248, prior to use, with stain-sensitive stone	

Guide to Sealant Types - EXTERIOR					
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions	
	General Exterior Glazing	Silicone; Neutral-cure	Tremco "Spectrem 2" or "Proglaze"	Exception: Select alternate silicone sealant types as appropriate for specific glazing application.	
	Butt Glazing and Structural Silicone Joints	Silicone; 1-part, Neutral-cure	Dow Corning "795"	--	
	Fabrication of Insulating Glass Units (IGU)	Primary Seal: Polyisobutylene	Select high quality sealants, of basic type listed, as appropriate for specific application.		
		Secondary Seal: Silicone	Dow Corning "982"	--	
	Zone dams, shear blocks and other internal component of Aluminum Window Systems	Silicone	Use type or silicone which offers optimal adhesion and performance for application.		
	Sheet Metal Gutters, Downspouts, Scuppers, etc	Synthetic Rubber / Resin, elastomeric	Tremco "Gutter Sealant"	--	
	Joints where Silicone was previously used	Silicone	Use type or silicone which offers optimal adhesion and performance for condition, and which offers suitable color choices for matching.		
Exterior Flatwork	Concrete Paving and Parking Structures	Multi-part Polyurethane	Tremco "THC 900 / 901"	Exception: Where subject to continual water emersion; use "Vulkem 45 or 245"	
	Concrete Sidewalks				
	Brick Paving and Walks				
	Stone and Precast Plazas				

General Notes:

1. The above shall be use as a "guide" to selection of appropriate sealant types.
2. Optional sealant products shall offer same number of color choices as the Base Product listed.
3. All of the conditions and materials listed may not necessarily apply to subject project.
4. The above is intended to be an overall guide. Additional conditions and materials may be required on subject project. Notify Architect if additional Guidance is required to select unlisted items.

3.2 PREPARATION

- A. Clean joints.
- B. Where finish coating or covering is to be applied to surface (e.g., paint, wall covering, glazed coating), wait until such coating or covering has been applied before installing sealant.

3.3 INSTALLATION –GENERAL

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- G. Make joints water and air tight.
- H. As required by manufacturer, prime joint surfaces.
1. Limit application to surfaces to receive sealants.
 2. Mask off adjacent surfaces.
- I. Make depth of sealant not more than one-half width of joint, but in no case less than 1/4 IN.
- J. Subcaulk joints without suitable backstop, to proper depth.
- K. Install correctly sized backer rods.
- L. Apply bond breaker as required or recommended by sealant manufacturer.
- M. Tool sealants using sufficient pressure to fill voids.
- N. Upon completion, leave caulking smooth and even.
- O. Install to completely fill voids.

3.4 INSTALLATION – PRE-MOLDED COMPRESSIBLE SEALANT

- A. Install compressible sealant to position at indicated depth.
1. Take care to avoid contamination of sides of joint.
 2. Protect side walls of joint to depth of caulking.
 3. Install with adhesive faces in contact with joint sides.
 4. Field apply silicone corner bead sealant at face each side of expansion joint in accordance with compressible sealant manufacturer recommendations.

END OF SECTION

SECTION 07 92 16
INTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Definition:
 - 1. Words “caulk” and “caulking” mean sealant work.
 - 2. “Interior wet areas” means toilets, showers, kitchens and similar areas where sealant is subject to moisture.
- B. Seal joints which would otherwise permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Work included: Provide sealants as follows:
 - 1. Masonry control joints, and between masonry and other materials.
 - 2. Flooring joints.
 - 3. Isolation joints.
 - 4. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
 - 5. Perimeters of door and window frames, louvers, grilles, etc.
 - 6. Between cabinets, casework, countertops and back splashes where adjacent to walls.
 - 7. Joints between dissimilar materials, to provide visually acceptable closures.
 - 8. Other joints where caulking, or sealant is indicated.
- D. Related materials specified elsewhere:
 - 1. Exterior Joint Sealants: See Section 07 92 13.
 - 2. Pre-molded Compressible Sealants: See Section 07 92 13.
 - 3. Firestopping: Specified in Section 07 84 00.
 - 4. Acoustical Sealant: Specified in Section 09 29 00.

1.2 QUALITY ASSURANCE

- A. Sealant materials:
 - 1. Sealant specification: ASTM-C920 Type S or M, Grade-NS, minimum Class-25.
 - 2. Sealant testing: ASTM-C510; ASTM-C711; ASTM-C719 Class-25, Grade-N; ASTM-C792; ASTM-C793; ASTM-C910.
 - 3. Sealant use: ASTM-C1193.
 - 4. Sealant VOC specifications: South Coast Air Quality Management District (SCAQMD), Rule #1168.
 - 5. Installer approved by manufacturer.
- B. Staining Potential (of adjacent materials caused by sealants):
 - 1. Pre-test proposed sealants where sealants are used with any of the following materials:
 - a. Brick Masonry.
 - b. Concrete Masonry.
 - 2. Test Method: ASTM-C1248.
 - 3. Historical testing using same materials and cataloged by sealant manufacturer will be considered acceptable.
 - 4. Where testing suggests that staining potential exists: Reselect sealant and retest.
 - 5. Certify that staining potential has been evaluated.
- C. Environmental Reference Standards:
 - a. South Coast Air Quality Management District (SCAQMD), Rule #1168.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Sealant Schedule with the following information:
 - a. Generally describe locations requiring sealants (i.e. Brick to Alum Window).
 - b. List type of sealant to be used, and name of product proposed.
 - c. Include a blank column on schedule for colors.
 - d. Upon review, Architect to complete Color Column.
- B. Samples:
 - 1. Cured sample of each color for color selection (submit with Sealant Schedule).
- C. Project Information:
 - 1. Certificate that furnished sealants meet minimum VOC requirements as specified by the California South Coast Air Quality Management District Rule.
- D. Contract Closeout Information:
 - 1. Warranty.
- E. LEED Information:
 - 1. MR 5.1 & 5.2 –Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 2. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants indicating VOC content of adhesives and sealants.,

1.4 JOB CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degF.
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

1.5 WARRANTY

- A. Provide written warranty that sealant work will remain free of defects for a period of 2 years:
 - 1. Failure of water tightness constitutes defect.
 - 2. Remove defective work and materials and replace with new work and materials.
 - 3. Repair other work damaged as a result of defective sealant work at no additional expense to Laboratory.
 - 4. Warranty signed by Installer and/or Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Polyurethane sealants:

- a. Base:
 - 1) Tremco.
 - b. Optional:
 - 1) Pecora.
 - 2) Sonneborn/ChemRex.
 - 3) Sika.
 - 4) Bondaflex Technologies.
2. Silicone sealants:
- a. Base:
 - 1) Tremco.
 - 2) Dow Corning.
 - b. Optional:
 - 1) Pecora.
 - 2) GE Silicones.
 - 3) Sonneborn/ChemRex.
 - 4) Bondaflex Technologies.
3. Other Sealants:
- a. Base: As indicated.
4. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 SEALANTS - GENERAL

- A. General:
- 1. Provide colors matching materials being sealed.
 - 2. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
 - 3. Use non-sag sealant in vertical and horizontal joints.
 - 4. Use self-leveling in horizontal joints.
 - 5. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
 - 6. Use only compatible materials.
 - 7. Obtain sealants from manufacturers who will provide manufacturers' field service representatives at project site for purpose of advising and instructing installers.
 - a. Provide such services, at no expense to Laboratory.
 - 8. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content in accord with SCAQMD Rule #1168:
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
- B. Polyurethane Sealants:
- 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws or specified otherwise.
 - 3. Not more than 250 g/L VOC in compliance with SCAQMD Rule #1168.
- C. Silicone Sealants:
- 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws or specified otherwise.
 - 3. Not more than 250 g/L in compliance with SCAQMD Rule #1168.
- D. Other Sealant Types:
- 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws or specified otherwise.
 - 3. VOC content no greater than 250 g/L in compliance with SCAQMD Rule #1168.

2.3 MISCELLANEOUS MATERIALS

- A. Joint cleaner, primer, bond breaker:

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1. As recommended by sealant manufacturer.
 2. No greater than 250 g/L VOC content in for non-porous applications in accord with SCAQMD Rule #1168.
 3. No greater than 775 g/L VOC content for porous applications in accord with SCAQMD Rule #1168.
- B. Backer Rod:
1. Rod stock of polyethylene, polyethylene jacketed polyurethane foam, or other flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer to:
 - a. Control joint depth.
 - b. Break bond of sealant at bottom of joint.
 - c. Provide proper shape of sealant.

PART 3 - EXECUTION

3.1 SEALANT USAGE GUIDELINES

Guide to Sealant Types - INTERIOR				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
Interior (General)	Window Sills / Stools	Product specified in Section 12 34 00 (100% silicone by Color Rite)		
	Cabinets and Casework to wall			
	Countertops and Backsplashes			
	Sinks in Countertops			
	Interior Alum Doors and Window Frame Perimeters	Multi-part Polyurethane, chemically curing, epoxidized	Tremco "Dymeric 240FC"	--
	Hollow Metal Door and Window Frames	Siliconized Acrylic Latex (paintable)	Tremco "Tremflex 834"	Exception: Where sealant will not be subsequently painted, and white color will not be visually compatible with adjacent finishes: Use "Dymeric 240FC" of matching color.
	Acoustical Sealant Joints at top and bottom terminations of Interior Walls	Specified In Section 09 29 00 (and in Section 07 84 00 where fire-rated)		
Interior Flatwork	Control Joints in Concrete Floors in Mechanical Rooms and other "un-finished" spaces	Multi-part Polyurethane	Tremco "THC 900 / 901"	Exception: Where subject to continual water emersion; use "Vulkem 45 or 245"
	Stone and Precast Flooring			
Interior Wet Areas	Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints	Silicone; Air cure	Tremco "Tremsil 200"	--
General Notes: <ol style="list-style-type: none"> 1. The above shall be use as a "guide" to selection of appropriate sealant types. 2. Optional sealant products shall offer same number of color choices as the Base Product listed. 3. All of the conditions and materials listed may not necessarily apply to subject project. 4. Not all project conditions may be addressed on above table; Refer also to other specification sections and install sealants where called for by other sections. 5. The above is intended to be an overall guide. Additional conditions and materials may be required on subject project. Notify Architect if additional Guidance is required to select unlisted items. 6. Materials and Conditions "conventionally" occur on Exterior but used on Interior of this project may not be listed on this Table. Refer to Exterior Guide (Section 07 92 13) for appropriate sealant type. i.e. If project calls for Brick Masonry on interior: Refer to Section 07 92 13 for type of Sealant to be used. 				

3.2 PREPARATION

- A. Clean joints.

- B. Where finish coating or covering is to be applied to surface (e.g., paint, wall covering, glazed coating), wait until such coating or covering has been applied before installing sealant.

3.3 INSTALLATION -GENERAL

- A. General:
 - 1. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
 - 2. Make joints water and air tight.
 - 3. Make depth of sealant not more than one-half width of joint, but in no case less than 1/4 IN.
 - 4. Install correctly sized backer rods.
 - 5. Apply bond breaker as required or recommended by sealant manufacturer.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Prime joint surfaces as recommended by sealant manufacturer for conditions:
 - 1. Limit application to surfaces to receive sealants.
 - 2. Mask off adjacent surfaces.
- F. Sub-caulk joints without suitable backstop, to proper depth.
- G. Tool sealants using sufficient pressure to fill voids.
- H. Upon completion, leave caulking smooth and even.
- I. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- J. Hollow Metal Door Frames:
 - 1. Seal frames to wall.
 - 2. Seal frames to floor substrates and hard floor finishes (do not seal to previously installed carpet and similar finishes.)

END OF SECTION

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SECTION 07 95 13
INTERIOR EXPANSION JOINT COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Interior Expansion Joint Covers, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Fire-rated Joints:
 - 1. Utilize Fire-rated as appropriate for conditions (refer to Plans for indication of fire ratings of walls, floors and ceilings).
 - 2. Assemblies with fire resistance and cycling capability as been determined per UL-2079.
 - 3. Fire rating not less than the rating of adjacent construction.
 - 4. Minimum Loading Capacities:
 - a. Standard Floor Joints: 500 LBS without damage or permanent deformation.
 - b. Heavy-duty Floor Joints: Point load of 2,000 LBS.
 - c. Wall Joints: Shall be designed to withstand a minimum impact load of 75 LBS/Lineal FT without damage or permanent deformation when tested per ASTM-F476.
- B. Single-Source Responsibility: Obtain expansion joint cover assemblies, including fire blankets, from one source from a single manufacturer.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout drawings and details.
- B. Samples:
 - 1. Standard metal finishes for color selection.
 - 2. Standard preformed seal extrusion colors for selection.
- C. LEED Information:
 - 1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 PROJECT CONDITIONS

- A. Check actual locations of walls and other construction to which work must fit, by accurate field measurements before fabrication.
 - 1. Show recorded measurements on Shop Drawings and coordinate fabrication schedule with construction progress to avoid delay of work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Interior Expansion Joint Covers:

1. Base:
 - a. C/S Group.
 2. Optional:
 - a. Balco/Metalines.
 - b. MM Systems.
 - c. InPro.
 - d. Pittcon Industries.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS – GENERAL

- A. General:
1. Continuous extruded aluminum frame assemblies with floating cover plate and seal.
 2. Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated.
 3. Furnish units in longest practicable lengths to minimize number of end joints.
 4. Locate end joints in non-conspicuous areas; avoid locating in high-traffic areas such as corridors.
 5. Provide hairline-mitered corners where joint changes directions or abuts other materials.
 6. Include closure materials and transition pieces, tee-joints, corner, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.
 7. Curved units: Provide factory-fabricated curved sections.
 8. Floor Joints:
 - a. ADA compliant.
 - b. Slab Edge Conditions:
 - 1) New floor slabs: Provide block-out requirements for new slab-edges prior to placement of concrete.
 - 2) Existing slab edges:
 - a) Remove portions of existing slab edge as required to receive new EJ covers; Surface-applied types will not be acceptable.
- B. Aluminum Frames:
1. Extrusions: ASTM-B221, alloy 6063-T5.
 2. Sheet and Plate: ASTM-B209, alloy 6061-T6.
 3. Protect aluminum surfaces in contact with cementitious materials with heavy metal free high solids primer or chromate conversion coating.
 4. Exposed surfaces: Mill finish.
- C. Extruded Preformed Seals:
1. Thermoplastic, extruded rubber: Classified under ASTM-D2000 and formed to fit frames.
 2. Rigid edges for positive attachment to frame and center plate.
 3. Smooth surface; free from grooves or ridges.
 4. Seals to have flexible core of shore hardness 73 to allow movement of joint width without gaps occurring between seal and cover assembly.
 5. Replaceable without removal of center plate.
 6. Color: To be selected by Architect.
- D. Fire Barrier Systems:
1. Designed for indicated or required dynamic structural movement without material degradation or fatigue in accordance with ASTM-E1399.
 2. Prefabricated, for hourly rating of adjacent floors, walls or ceiling assemblies.
 - a. Tested in maximum joint width condition as a component of an expansion joint cover in accordance with UL-2079 including hose stream testing of wall assemblies at full-rated period by Underwriters Laboratories Inc.
 3. Material to carry UL-labeled and be subject to Underwriters Laboratories follow-up service for quality assurance.

4. Systems to be installed strictly in accordance with manufacturer's installation instructions.
 5. Supply in maximum lengths to minimize field splicing.
 6. Fire barrier to consist of intumescent blankets layered to provide a flame and insulation barrier and to accommodate dynamic movement.
 7. Expansion Joints in concealed spaces such as chase walls: Fire barrier system to include 0.032 IN thick galvanized steel cover in lieu of conventional (finished) expansion joint cover.
 8. Base Products:
 - a. "Fire Barrier Model FB-97," "FB-83," and/or "FB-88" by C/S.
 - b. Select appropriate model number for joint width, fire rating required, and other joint conditions as applicable.
- E. Accessories:
1. Manufacturer's standard anchors, fasteners, set screws, spacers, flexible vapor seals and filler materials, drain tubes, adhesive and other accessories compatible with material in contact, as indicated or required for complete installations.
- F. Schedule of Interior EJ's:

Schedule of Interior EJ's				
Mark #	Joint Width	Condition	Fire Rated	Remarks
EJ-1	2 IN	Floor joint	-	Slab-on-Grade Heavy-duty
EJ-2	2 IN	Floor Joint	2-HR	Elevated Slab
EJ-2W	2 IN	Wall Joints	Per Wall Type	Refer to Plans for Wall Types and Rating
EJ-2C	2 IN	Ceiling Joints	-	-
General Notes: <i>See Plans for locations of each type.</i> <i>See Plans for fire ratings of walls, floors and ceilings.</i>				

2.3 DESCRIPTION OF EJ-TYPES

- A. General:
1. Refer to schedule above to conditions and widths required for project.
 2. Refer to Plans for locations.
 3. Refer to the following for Base Products and further description of scheduled types.
- B. Floor Joints:
1. Base Products:
 - a. 1 to 2 IN Wide Joints: "Thinline Flush GFT Series" by C/S.
 - b. 2 to 4 IN Wide Joints: "Twinline Flush GFR Series" by C/S.
 - c. Floor-to-Wall Joints:
 - 1) Include floor-to-wall variations similar to above listed models.
 2. Include fire barrier components required, when joint is used in fire-rated floors.
- C. Wall Joints:
1. Base Product:
 - a. 1 to 2 IN Wide Joints: "Thinline Flush FWF Series" by C/S.
 - b. 2 to 4 IN Wide Joints: "Twinline Flush GFW Series" by C/S.
 2. Walls at intersecting angles: Include appropriate model variations for intersecting conditions.
 3. Include fire barrier components required, when joint is used in fire-rated walls.

- D. Ceiling Joints:
 - 1. Base Product:
 - a. 1 to 4 IN Wide Joints: "Thinline Flush FCF Series" by C/S.
 - 2. Ceiling-to-Wall conditions: Include appropriate model variations.

2.4 OTHER EXPANSION JOINTS TYPES (SPECIFIED ELSEWHERE)

- A. Expansion Joints at Roofing:
 - 1. Specified in Section 07 62 00 (and/or in applicable roofing section(s)).
- B. Expansion Joints in "Exterior" Walls:
 - 1. See Compressible Sealants, Specified in Section 07 92 13.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Do not install until deficiencies are corrected.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Insure the completeness of the work required under this Section.
- B. Verify all measurements and dimensions at the job site.
- C. Coordinate work with related trades, with particular attention given to the installation of items embedded in concrete and masonry so as not to delay job progress.
- D. Provide all templates, block-outs, and embedded items as required.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Set work level, true to line, plumb.
- C. Install fire barrier caulk as required for UL assembly specified.
- D. Comply with manufacturer's instructions and recommendations for all phases of work, including preparation of substrate, applying materials, and protection of installed units.
- E. Provide anchorage devices and fasteners where necessary for securing expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete.
 - 1. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.
- F. Perform all cutting, drilling, and fitting required for installation of expansion joint covers.
 - 1. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels.
- G. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
- H. Set floor covers at elevations to be flush with adjacent finished floor materials.
 - 1. If necessary, shim to level, but ensure base frames have continual support to prevent rocking and vertical deflection.
- I. Locate wall, ceiling, roof, and soffit covers in continuous contact with adjacent surfaces.

1. Securely attach in place with all required accessories.
- J. Locate anchors at interval recommended by manufacturer, but not less than 3 IN from each end and not more than 24 IN on centers.
- K. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
 1. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames.
- L. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- M. Installation of Extruded Preformed Seals:
 1. Install seals to comply with manufacturer's instruction and with minimum number of end joints.
 2. For straight sections provide preformed seals in continuous lengths.
 3. Vulcanize or heat-seal all field splice joints in preformed seal material to provide watertight joints using manufacturer's recommended procedure.
 4. Apply manufacturer's approved adhesive, epoxy, or lubricant-adhesive to both frame interfaces prior to installing preformed seal.
 5. Seal transitions in accordance with manufacturer's instruction.
- N. Installation of Fire Barrier:
 1. Install fire barrier in accordance with federal, state, and Building Code as locally amended using manufacturer's recommended procedures.
 2. Install transition and end joints to provide continuous fire resistance and in accordance with manufacturer's instructions.

3.4 CLEANING AND PROTECTION

- A. Do not remove strippable protective material until finish work in adjacent areas is complete.
- B. When protective material is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

END OF SECTION

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SECTION 07 95 14
EXTERIOR SEISMIC EXPANSION JOINT COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Exterior Seismic Expansion Joint Covers, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Check actual locations of walls and other construction to which work must fit, by accurate field measurements before fabrication.
 - 1. Show recorded measurements on Shop Drawings and coordinate fabrication schedule with construction progress to avoid delay of work.
- B. Fire-rated Joints:
 - 1. Utilize Fire-rated as appropriate for conditions (refer to Plans for indication of fire ratings of walls, floors and ceilings).
 - 2. Assemblies with fire resistance and cycling capability as been determined per UL-2079.
 - 3. Fire rating not less than the rating of adjacent construction.
 - 4. Minimum Loading Capacities:
 - a. Standard Floor Joints: 500 LBS without damage or permanent deformation.
 - b. Heavy-duty Floor Joints: Point load of 2,000 LBS.
 - c. Wall Joints: Shall be designed to withstand a minimum impact load of 75 LBS/Lineal FT without damage or permanent deformation when tested per ASTM-F476.
- C. Single-Source Responsibility: Obtain expansion joint cover assemblies, including fire blankets, from one source from a single manufacturer.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout drawings and details
- B. Samples:
 - 1. Finishes for color selection.
- C. LEED Information:
 - 1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Exterior Seismic Expansion Joint Covers:
 - 1. Base:
 - a. C/S Group.
 - 2. Optional:

- a. Balco/Metalines.
- b. MM Systems.
- c. InPro.
- d. Pittcon Industries.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS – GENERAL

A. General:

- 1. Continuous extruded aluminum frame assemblies with floating cover plate and seal.
- 2. Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated.
- 3. Furnish units in longest practicable lengths to minimize number of end joints.
- 4. Locate end joints in non-conspicuous areas; avoid locating in high-traffic areas such as corridors.
- 5. Provide hairline-mitered corners where joint changes directions or abuts other materials.
- 6. Include closure materials and transition pieces, tee-joints, corner, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.
- 7. Curved units: Provide factory-fabricated curved sections.

B. Aluminum Frames:

- 1. Extrusions: ASTM-B221, alloy 6063-T5.
- 2. Sheet and Plate: ASTM-B209, alloy 6061-T6.
- 3. Protect aluminum surfaces in contact with cementitious materials with heavy metal free high solids primer or chromate conversion coating.
- 4. Exposed surfaces: Mill finish.

C. Fire Barrier Systems:

- 1. Designed for indicated or required dynamic structural movement without material degradation or fatigue in accordance with ASTM-E1399.
- 2. Prefabricated, for hourly rating of adjacent floors, walls or ceiling assemblies.
 - a. Tested in maximum joint width condition as a component of an expansion joint cover in accordance with UL-2079 including hose stream testing of wall assemblies at full-rated period by Underwriters Laboratories Inc.
- 3. Material to carry UL-labeled and be subject to Underwriters Laboratories follow-up service for quality assurance.
- 4. Systems to be installed strictly in accordance with manufacturer's installation instructions.
- 5. Supply in maximum lengths to minimize field splicing.
- 6. Fire barrier to consist of intumescent blankets layered to provide a flame and insulation barrier and to accommodate dynamic movement.
- 7. Expansion Joints in concealed spaces such as chase walls: Fire barrier system to include 0.032 IN thick galvanized steel cover in lieu of conventional (finished) expansion joint cover.
- 8. Base Products:
 - a. "Fire Barrier Model FB-97," "FB-83," and/or "FB-88" by C/S.
 - b. Select appropriate model number for joint width, fire rating required, and other joint conditions as applicable.

D. Accessories:

- 1. Manufacturer's standard anchors, fasteners, set screws, spacers, flexible vapor seals and filler materials, drain tubes, adhesive and other accessories compatible with material in contact, as indicated or required for complete installations.

E. Schedule of Exterior ESEJ's:

Schedule of Interior EJ's				
Mark #	Joint Width	Condition	Fire Rated	Remarks
BRJW-100	1 IN	Curb/Wall	1 Hour	
BRJ-200	2 IN	Curb/Curb	1 Hour	
BRJW-200	2 IN	Curb/Wall	1 Hour	
SF-200	2 IN	Curtain Wall/ Curtain Wall	--	
VF-100	1 IN	Wall/Wall	1 Hour	
VF-200	2 IN	Wall/Wall	1 Hour	

2.3 DESCRIPTION OF ESEJ-TYPES

A. General:

1. Refer to schedule above to conditions and widths required for project.
2. Refer to Plans for locations.
3. Refer to the following for Base Products and further description of scheduled types.

B. Exterior roof joints:

1. Base Products:
 - a. 1 IN and 2 IN Wide Joints: "BRJ Series" by C/S.
 - b. Provided with roofing installation.

C. Exterior curtain wall joints:

1. Base Products:
 - a. 2 IN Wide Joint: "SF Series" by C/S.
 - b. Provided with curtain wall installation.

D. Exterior wall joints:

1. Base Products:
 - a. 1 IN and 2 IN Wide Joints: "VF Series" by C/S.

2.4 OTHER EXPANSION JOINTS TYPES (SPECIFIED ELSEWHERE)

A. Interior Expansion Joints:

1. Specified in Section 07 95 13.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Do not install until deficiencies are corrected.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Insure the completeness of the work required under this Section.

- B. Verify all measurements and dimensions at the job site.
- C. Coordinate work with related trades, with particular attention given to the installation of items embedded in concrete and masonry so as not to delay job progress.
- D. Provide all templates, block-outs, and embedded items as required.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Set work level, true to line, plumb.
- C. Install fire barrier caulk as required for UL assembly specified.
- D. Comply with manufacturer's instructions and recommendations for all phases of work, including preparation of substrate, applying materials, and protection of installed units.
- E. Provide anchorage devices and fasteners where necessary for securing expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete.
 - 1. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.
- F. Perform all cutting, drilling and fitting required for installation of expansion joint covers.
 - 1. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels.
- G. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
- H. Locate anchors at interval recommended by manufacturer, but not less than 3 IN from each end and not more than 24 IN on centers.
- I. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
 - 1. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames.
- J. Installation of Fire Barrier:
 - 1. Install fire barrier in accordance with federal, state and Building Code as locally amended using manufacturer's recommended procedures.
 - 2. Install transition and end joints to provide continuous fire resistance and in accordance with manufacturer's instructions.

3.4 CLEANING AND PROTECTION

- A. Do not remove strippable protective material until finish work in adjacent areas is complete.
- B. When protective material is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL (HM) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Hollow Metal Doors and Frames, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Hollow Door and Frame Standards:
 - 1. ANSI/SDI-A250.4 for Physical Performance.
 - 2. ANSI/SDI-A250.8 for Level, Model, and overall requirements.
- B. Fire rated doors and frames:
 - 1. Provide doors which are identical in materials and construction to units in door and frame assemblies tested in accordance NFPA 252, NFPA 80, and UL10C (Positive Pressure).
 - 2. Provide doors which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 3. Physical label or approved marking shall be affixed to fire door or fire door frame, at an authorized facility as evidence of compliance with procedures of labeling agency.
 - 4. Provide 450 degF temperature rise doors at stairs and other exit enclosures.
 - 5. Positive Pressure:
 - a. Comply with Positive Pressure Requirements UL 10C, Category A.
 - b. Provide "S" labels where required.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Door and frame schedule.
- B. LEED Information:
 - 1. MR 4.1& 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 & 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Base:
 - a. Steelcraft Manufacturing.
 - 2. Optional:
 - a. Curries.
 - b. Ceco Door Products.
 - c. Republic Doors and Frames.

- B. Thermally-Broken Hollow Metal Frames:
 - 1. Base:
 - a. Curries.
 - 2. Optional:
 - a. Ceco Door Products.

2.2 MATERIALS

- A. Steel sheet and strip:
 - 1. Typical: ASTM-A568.
- B. Corrosion-resistant coating:
 - 1. Standard:
 - a. Hot-dip Galvannealed: A60 per ASTM-A653.
 - b. Minimum zinc-iron alloy coating: 0.6 OZ/FT².
 - 2. Application: Provide above corrosion-resistant coating at all door and frame components where used at exterior and interior wet and humid locations as defined by following:
 - a. Exterior openings:
 - 1) Openings located in an exterior wall.
 - 2) Openings that are exposed to weather even if protected by overhead canopy.
 - 3) Openings used for roof access.
 - 4) Openings to and from loading docks, trash collection and compacting areas.
 - b. Interior openings in “wet and humid” areas:
 - 1) Openings to and from rooms with showers, tubs or pools.
 - 2) Openings to and from operating rooms, scrub areas, sub-sterile, trauma rooms, hydrotherapy rooms, and decontamination showers.
 - 3) Openings to and from soiled utility and soiled holding rooms.
 - 4) with sterilizer, Central Sterile Reprocessing department.
 - 5) Openings to and from loading docks, trash collection and compacting areas.
 - 6) Openings to ambulance and vehicular garages.
 - 7) Openings to and from rooms with sterilizers, autoclaves, tunnel washer equipment and similar Central Sterile Reprocessing equipment.
- C. Primer:
 - 1. Doors and frames shall be cleaned, phosphatized and finished as standard with one coat of baked-on rust inhibiting primer paint in accordance with ANSI A250.10.
 - 2. Primer shall be suitable and compatible as base for specified finish paints.
- D. Zinc-rich primer for repair of galvanized/galvannealed items: Galvilit by ZRC Worldwide.

2.3 GENERAL REQUIREMENTS – HOLLOW METAL (HM) DOORS

- A. General:
 - 1. Comply with ANSI/SDI A250.8.
- B. Determination of performance level for each door:
 - 1. In accordance with following schedule, use indicated level of HM door indicated for its location, size and other listed criteria.
 - a. Note: Not all items below may apply to subject project.

Schedule of HM Door Levels			
Location	Additional Criteria	Use ANSI Level:	Miscellaneous
Exterior Doors ¹ (flush)	Openings where each leaf is less than 47 IN	Level 3 (Extra Heavy-duty)	Galvanized / galvannealed, Thermally Insulated
	Openings where one or more of the leaves exceeds 47 IN	Level 4 (Maximum-duty)	

Interior Doors	Non-fire rated	Level 3 (Extra Heavy-duty)	--
	Fire rated	Level 3 (Extra Heavy-duty)	Labeled as indicated (w/out astragal wherever possible)
	Wet / Humid Areas ²	Level 3 (Extra Heavy-duty)	Galvanized / galvanized; Moisture-resistant core - Fire-resistant were required

General Notes:

Refer to Door Schedule for indication of the Door Type (i.e. Width, Fire Rating, Flush vs. Stile & Rail, etc)

Refer to Plans for door location (Exterior vs. Interior)

Where Hurricane or Tornado-resistant openings are specified: Refer "ADDITIONAL REQUIREMENTS" for appropriate door/frame construction.

Footnotes:

1. Refer to Part 2.2 for definition of "Exterior" locations.
2. Refer to Part 2.2 for definition of "Wet/Humid" locations.

C. Construction - Hollow Metal (HM) Doors:

1. Door Thickness:
 - a. 1-3/4 IN.
 2. HM Door Level, per ANSI-A250.8:
 - a. Level 3, Extra Heavy-duty, physical performance Level A.
 - 1) Face Sheet Thickness: 16 GA.
 - b. Level 4, Maximum-duty, physical performance Level A.
 - 1) Face Sheet Thickness: 14 GA.
 3. Typical Model, per ANSI-A250.8:
 - a. Model 2, Seamless.
 1. End closures at top and bottom of door:
 - a. Top:
 - 1) Flush closure top cap. Minimum Sheet thickness: 20 GA.
 - b. Bottom:
 - 1) Flush closure. Minimum Sheet thickness: 20 GA.
 2. Cores:
 - a. Steel stiffeners where structurally required.
 - b. Exterior Doors:
 - 1) Thermally insulated cores.
 - 2) Minimum R-value: 0.704 K x M²/W 4.0 DegF x H x FT²/BTU when tested according to ASTM-C1363.
 - 3) Exception: Fire resistant core where rating is indicated for exterior doors.
 - c. Interior doors:
 - 1) Non-rated doors: Kraft honeycomb laminated to face sheets.
 - 2) Rated doors: Fire resistant core as required by label.
 - 3) Wet/Humid Areas: Moisture-resistant materials, fire resistant where applicable.
 - d. Specific materials used for above listed core types: Manufacturer's option.
 - e. Reinforce for Hardware.
 3. Vertical Door Edges:
 - a. Lock Stile Edges: Beveled 1/8 IN per 2 IN.
 - 1) Exception for inactive leaves: Fabricate inactive leaves with a square edge at the lock stile edge. Active leaves to be beveled per above.
 - b. Hinge Stiles Edge: Beveled 1/8 IN per 2 IN.
 - c. Exceptions for Double-Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles.
- D. Hardware Reinforcement:
1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as door face sheets.
 2. Minimum thickness: As prescribed in ANSI/SDI A250.6; Upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - a. Butt Hinges: 7 GA.

- b. Continuous hinges: Reinforce with 14 GA x1-1/4 IN strapping extending full height and welded to hinge edge of door.
 - c. Closers and Overhead Stops: 14 GA.
- E. Lites:
- 1. Provide light kits which are labeled for intended opening.
 - 2. Fixed Stop:
 - a. Locate at exterior face.
 - b. Integral to door/frame.
 - 3. Removable Stop:
 - a. Locate on interior face.
 - b. Screw-less snap-in stops or stops secured with countersunk Phillips head machine screws.
- F. Overlapping Astragals:
- 1. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00 / Hardware.
 - 2. Weatherstripping: Specified in Section 08 71 00.

2.4 GENERAL REQUIREMENTS – HOLLOW METAL (HM) FRAMES

- A. General:
- 1. Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
 - 2. Fabricate frames with mitered or coped corners.
 - 3. Fastenings: Fully concealed.
 - 4. Touch-up galvanized/galvannealed frames with zinc-rich primer.
- B. Fabricate frames as face-welded.
- 1. Continuously weld face and return flanges.
 - 2. Fill and finish exposed sides to be free of visible seams.
 - 3. Split type frames and knock-down type frames are not acceptable.
 - 4. Intersections of Rabbets, Stops and Soffit Joints:
 - a. Spot-weld on concealed-side.
- C. Determination of steel gauge for each frame:
- 1. Per following schedule, use the indicated minimum steel gauge as indicated for its location, size and other listed criteria.
 - 2. Note: Some of the items below may not apply to subject project.

Schedule of HM Frames			
Location	Criteria	Minimum Gauge	Miscellaneous
Exterior Frames ¹	Where overall width of frame is less than 47 IN	14 GA	Galvanized / galvannealed
	Where overall width of frame is greater than 47 IN	12 GA	
Interior Frames ¹	Non-fire rated	16 GA	---
	Fire rated	16 GA	---
	Wet / Humid Areas ²	16 GA	Galvanized / galvannealed

General Notes:

Gauge of frame listed is "minimum". Use heavier gauge as required due to size, physical configuration or if required to meet fire label requirements.

Refer to Door Schedule for indication of the Frame Type (I.e. Width, Single vs. Pair; Fire Rating, etc)

Refer to Plans for door location (Exterior vs. Interior)

Where Hurricane or Tornado-resistant openings are specified: Refer "ADDITIONAL REQUIREMENTS" for appropriate door/frame construction.

Footnotes:

- 1. Refer to Part 2.2 for definition of "Exterior" locations.
- 2. Refer to Part 2.2 for definition of "Wet/Humid" locations.

- D. Thermally-broken HM Frames:
1. Description: Two steel sections mechanically joined together, but separated by a continuous, low-conductivity, thermal break material.
 2. Otherwise construct as specified for conventional frames.
 3. Utilize thermally-broken hollow metal frames at all exterior openings on this project.
- E. Lites:
1. Provide light kits labeled for intended opening.
 2. Fixed Stop:
 - a. Locate at exterior face.
 - b. Integral to door/frame.
 3. Removable Stop:
 - a. Locate on interior face.
 - b. Screw-less snap-in stops or stops secured with countersunk Philips head machine screws.
- F. Silencers:
1. Specified in Section 08 71 00.
 2. Quantity:
 - a. 3 on strike jamb of single frames.
 - b. 2 per door for pair doors. Locate at head.
 3. Space per manufacturer's recommendations.
 4. Use plastic plugs to keep holes clear during construction.
- G. Hardware Reinforcement:
1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
 2. Minimum thickness: As prescribed in ANSI/SDI A250.6; upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - a. Butt Hinges: 7 GA.
 - b. Continuous hinges: Reinforce with 14 GA x1-1/4 IN strapping extending full height and welded to hinge jamb door rabbet of frame.
 - c. Closers and Overhead Stops: 12 GA thick x 12 IN-long strapping welded to vertical flange of frame.
- H. Head Stiffeners for Double-egress Frames:
1. Purpose: To compensate for loss of stiffness at midspan due to discontinuity of head stops.
 2. Configuration: 12 IN long strapping welded to each vertical flange of frame.
 3. Minimum Thickness: 12 GA.
 4. Position stiffeners at mid-span of frame opening.
- I. Cover Boxes:
1. Material: 16 GA sheet steel.
 2. Size and shape: As required by hardware device.
 3. Include knock-out to receive 1/2 IN conduit.
 4. Locate Cover Boxes in all frames scheduled to receive electrified Security or Door Hardware devices or both.
 - a. Devices including, but not limited to: Electric Strikes, Maglocks, Door Position Switches, Current-conducting hinges, etc.
- J. Jamb Anchors:
1. General:
 - a. Material: ASTM-A591 Commercial Steel, 12G 40Z coating; mill phosphatized.
 - 1) Exception for frames built into exterior walls: Steel sheet complying with ASTM-A1008 or ASTM-A1011, hot-dip galvanized according to ASTM-A153, Class B.
 - b. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.

- c. Provide minimum number as indicated on following Table:

Jamb Anchors Minimum Quantity Required (per Jamb)	
Nominal Frame Height	Minimum Quantity per Jamb
Up to 60 IN	2
Between 60 IN and 90 IN	3
Between 90 IN and 120 IN	4
Between 120 IN and 150 IN	5
Taller than 150 IN	Add 1 additional for each 30 IN increase in height thereafter

2. Jamb Anchors for Stud-Framed walls:
 - a. Z-shaped clips, welded to inside of frames; not less than 1.0mm thick.
 - b. Attach anchors to studs with screws.
 3. Jamb Anchors for Masonry walls:
 - a. Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 1.0mm 18GA, with corrugated or perforated straps not less than 50mm 2 IN wide by 250mm 10 IN long; or wire anchors not less than 4.5mm 6GA thick.
 - b. Embed long leg into masonry wall as it is laid.
 4. Post-installed Expansion Type for In-Place Concrete (or Masonry):
 - a. Minimum 9.5mm 3/8 IN countersunk, flat-head expansion bolts with expansion shields or inserts.
 - b. Include pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - c. Minimum embedment length: 1-3/4 IN.
- K. Floor Anchors:
1. Material: Same for Jamb Anchors but not less than 1.4mm 0.053 IN (12 GA) thick.
 - a. For anchors built into exterior walls, steel sheet complying with ASTM-A1008 or ASTM-A1011, hot-dip galvanized according to ASTM-A153, Class B.
 2. Application:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - b. Topped Slabs: Adjustable-type anchors with extension clips, allowing not less than 50mm 2 IN height adjustment. Terminate bottom of frames at finish floor surface.
 3. Include concealed fasteners.
 4. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.
- L. Additional Head Anchors for Double Egress Frames:
1. Provide 2 frame anchors for Double Egress frames.
 2. Locate at 1/3 rd points of span.
- M. Spreaders:
1. Provide removable spreaders at bottom of door frames.
- N. Inserts, bolts and fasteners:
1. Manufacturer's standard units.
 2. Galvanize items to be built into exterior walls ASTM-A153, Class C or D as applicable.
- O. Grout:
1. Portland cement-based grout mixture: Specified in Section 04 05 13.
 2. Grout mixtures shall not contain gypsum.

2.5 FABRICATION

- A. General:
1. Fabricate rigid, neat in appearance and free from defects.
 2. Form to indicated sizes and profiles.

3. Fit and assemble in shop, wherever practical.
4. Mark work that cannot be fully assembled in shop, to assure proper assembly at site.
5. Door to Frame Clearances:

Door To Frame Clearances				
Rated / Non-rated	Location	Wood Doors	Hollow Metal Doors	
Rated Openings	Top Rail to Frame	3/32 to 1/8 IN	3/32 to 5/32 IN	
	Lock Stile to Jamb			
	Hinge Stile to Jamb			
	Meeting Stiles at Pair Doors	1/16 to 1/8 IN	1/16 to 1/8 IN	
	Face of door to face of Stop			
	Door Bottom to Floor / Flooring	Typical; all floor covering types	Up to 1/2 IN	Up to 1/2 IN
		At Non-combustible Sills	Up to 3/8 IN	Up to 3/8 IN
Bare floors; No flooring or sills		Up to 3/4 IN	Up to 3/4 IN	
Non-rated Openings	All Conditions	Comply with criteria listed for rated openings	Comply with criteria listed for rated openings	

- a. Comply also with additional requirements of the following where more stringent:
 - 1) ANSI A250.8.
 - 2) SDI 117.
 - 3) Fire-rated doors: NFPA 80.
 - 4) Smoke-Control Doors: NFPA 105.
 - 5) Locally adopted Building Code.
- B. Hardware Preparation:
 1. Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to Door Hardware Schedule and templates furnished as specified in Section 08 71 00.
 2. Locate hardware indicated, or if not indicated, according to ANSI/SDI A250.8.
 3. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
 4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 5. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.
- C. Remove mill scale and foreign materials, touch-up damaged galvanized or galvanized surfaces.
- D. Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors.
 2. Seal joints in top edges of doors against water penetration.
 3. Glazed Lites: Factory cut openings in doors.
 4. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
- E. Prime:
 1. Shop prime.
- F. Fire Labels:
 1. Affix permanent labels to fire rated units in accordance with testing agency requirements.
 2. At openings where continuous hinges, or other items when scheduled and installed would conceal fire label, locate labels on alternative locations as allowed by listing agency and local authorities.

- G. Prepare frames for Door Position Switches (DPS):
 - 1. Coordinate locations with Security System provider.
 - 2. Locate DPS frame head approximately 4 IN from latching door edge.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION QUALITY CONTROL

- A. Initially set frames plumb, level and square within allowable tolerances.
- B. Verify plumb, level and square after walls are set and make adjustments where required.
- C. Verify plumb, level and square again just prior to hanging doors, making adjustments as required. Insure that door-to-frame clearances are within specified tolerances.

3.3 INSTALLATION

- A. General:
 - 1. Install steel doors, frames, and accessories in accordance with approved shop drawings, manufacturer's data, and as specified.
 - 2. Place frames prior to construction of enclosing walls and ceilings.
 - 3. Coordinate building in of anchors, and frame grouting with other trades.
- B. Placing Frames:
 - 1. General:
 - a. Comply with provisions in ANSI A250.11/ SDI 105, unless otherwise indicated.
 - b. Install fire-rated frames according to NFPA 80.
 - 2. Place frames before construction of adjacent walls.
 - a. Exception: Where adjacent walls are cast-in-place concrete: Set frames 'after' wall is constructed.
 - 3. Set frames accurately in position, plumbed, aligned, and braced securely.
 - 4. Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Plumb: Plus or minus 1/16 IN, measured at jambs at floor.
 - b. Level: Plus or minus 1/16 IN per leaf, measured across width of header.
 - c. Square: Plus or minus 1/16 IN, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - d. Alignment: Plus or minus 1/16 IN, measured at jambs on horizontal line parallel to plane of wall.
 - e. Twist: Plus or minus 1/16 IN, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 5. Do not remove spreaders until surrounding wall construction is complete.
 - 6. After surrounding walls have been constructed, verify that frames are still in proper alignment.
 - a. Re-check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
 - b. Correct deficiencies before surrounding construction is allowed to proceed.
 - c. Work with wallboard installer, if necessary, to correct misalignment problems.
 - 7. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 8. Prior to hanging doors: Verify all aspects of frame alignment, and correct deficiencies.
 - 9. Install frames with removable glazing stops located on secure side of opening.

10. Install door silencers in frames before grouting.
 11. Field apply bituminous coating to backs of frames that are filled with grout.
- C. Frame-to-Wall Anchors:
1. Utilize anchor type specified for wall condition.
 2. Align anchors at hinge centers on hinge jamb and at corresponding heights on strike jamb.
 3. Secure frame to wall per manufacturer's instructions.
- D. Grout all frames set into Cast-in-Place Concrete, CMU, and other masonry walls.
1. Do not grout frames set into metal stud-framed wall types.
- E. Door Installation:
1. Comply with ANSI A250.8.
 2. Fit hollow-metal doors accurately in frames, within clearances specified.
 3. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
- F. Prime-Coat Touchup:
1. Immediately after erection, sand smooth rusted or damaged areas of primer coat.
 2. Touch up primer coat with compatible air-drying primer.
 3. Leave surfaces smooth for finish painting.
- G. Field Painting of HM Frames and Doors:
1. Painting of Exterior openings: Specified in Section 09 91 13.
 2. Painting of Interior openings: Specified in Section 09 91 23.
 3. Do not paint factory pre-finished doors such as stained faux wood (embossed steel) doors.
- H. Install Sealants:
1. Sealant (specified elsewhere):
 - a. Exterior Sealants: Specified in Section 07 92 13.
 - b. Interior Sealants: Specified in Section 07 92 16.
 2. Seal frames to walls.
 3. Seal frames to floor slabs and hard floor finishes.
- I. Install silencers.

3.4 ADJUSTING AND CLEANING

- A. Alignment:
1. After surrounding walls have been constructed, verify frames are remain in proper alignment.
 2. Check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
 3. Correct deficiencies before surrounding construction is allowed to proceed.
- B. Protection Removal:
1. Immediately before final inspection, remove protective wrappings from doors and frames.
- C. Leave work complete and in proper operating condition.
- D. Remove and replace defective work.
- E. Ensure that all fire labels are intact, and readily visible.

END OF SECTION

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SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Flush Wood Doors, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Quality Standards - General:
 - 1. Source limitations: Obtain flush wood doors through one source from a single manufacturer.
 - 2. Quality standard: Comply with WDMA I.S.1-A 04
 - 3. ANSI A115. W Series, Wood Door Hardware Standards.
- B. Manufacturing Standards:
 - 1. Window and Door Manufacturer's Association (WDMA) Industry Standard I.S. 1A-04
 - 2. Forestry Stewardship Council, (FSC).
- C. Fire Rated Door Standards:
 - 1. Provide items which are identical in materials and construction to units tested in door and frame assemblies in accordance NFPA 252, NFPA 80, and UL10C (Positive Pressure).
 - 2. Provide items which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 3. A physical label or approved marking shall be affixed to the fire door or fire door frame, at an authorized facility as evidence of compliance with procedures of the labeling agency.
 - 4. Doors at stairs and other exit enclosures: Provide 450 DegF temperature rise rating.
 - 5. Positive Pressure:
 - a. Comply with Positive Pressure Requirements UL 10C, Category A (concealed intumescent).
 - 1) The use of surface-applied intumescent is not an acceptable alternative unless written approval is given by Architect prior to bidding.
 - b. Comply with ASTM-E2074.
 - 6. Provide "S" labels where required.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Include details of construction for each type of door.
 - 2. Include factory finishing specifications.
 - 3. Provide manufacturer's technical data for each type of door including details of core and edge construction, trim for openings and factory-finishing specifications.
- B. Shop Drawings:
 - 1. Indicate location, size, and hand of each door; elevation of each kind of door; location and extent of hardware blocking; and other pertinent data.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire ratings for fire doors.
- C. Samples:

1. Samples for Verification: Factory finishes applied to actual door face materials for each material and finish.
 - a. For each wood species and finish, provide one piece of the expected finished work.
 - b. Minimum Size: 8 x 10 IN indicating finish.
- D. Contract Closeout Information:
 1. Warranty.
- E. LEED Information:
 1. MR 4.1& 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 2. MR 5.1 & 5.2, Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 3. MR 7.0, Certified Wood: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body; include statement indicating costs for each certified wood product.
 4. IEQ 4.2, Low-Emitting Materials – Paints and Coatings: Manufacturer’s product data indicating VOC content of field applied coatings.
 5. EQ 4.4, Low-Emitting Materials, Composite Wood & Agrifiber Products: For composite-wood and agrifiber products used, documentation indicating that the bonding agent contains no urea formaldehyde. For laminating adhesive used, furnish documentation indicating that adhesives contain no urea formaldehyde.

1.4 WARRANTY

- A. Warrant doors in writing for life of original installation against defects including:
 1. De-lamination, warp, twist, bow, telegraphing, and other defects that may impair or affect performance of door for purpose intended.
 - a. Allowable values as prescribed by Performance Standard specified.
 2. Remove and replace defective doors; include cost of removal of defective units, re-hanging and refinishing of replacement units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Wood Doors:
 1. Base:
 - a. Marshfield Door Systems.
 2. Optional:
 - a. Algoma Hardwoods.
 - b. Eggers Industries.
 - c. VT Industries.
 - d. Mohawk Flush Doors, Inc.
 - e. Oshkosh.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DOOR CONSTRUCTION – GENERAL

- A. General:
 1. Door Construction Method: 5-Ply, Hot press glued, solid core.
 2. Factory finished.

3. Performance Standards (per WDMA I.S. 1A-04):
 - a. "Extra Heavy Duty".
4. Adhesives:
 - a. Type(s) as required by WDMA Performance Standard specified.
 - b. Utilize waterproof adhesives for doors indicated near potentially wet conditions.
 - c. Conform to EPA VOC regulations.
5. Workmanship: Comply with WDMA I.S. 1A-04.
6. Thickness: 1-3/4 IN unless noted otherwise.
7. Width and Height as scheduled for each opening.

2.3 CORE CONSTRUCTION

- A. General:
 1. Manufacture in compliance with WDMA Standards.
 2. Select specific core types which comply with label for scheduled ratings, sizes and hardware devices.
 3. Bond cores to stiles and rails; "Drop-in" (un-bonded) cores are NOT acceptable.
 4. Engineered wood and wood-based composites shall not contain urea formaldehyde resin binders.
- B. Non-Fire Rated Doors:
 1. FSC certified formaldehyde-free particleboard.
- C. 20-minute Fire Rated doors:
 1. Core type indicated above for non-rated doors.
- D. Fire Rated Doors greater than 20 minutes:
 1. Manufacturer's standard mineral core construction as required by label and hardware scheduled.
 2. Provide manufacturers standard laminated edge construction with improved screw-holding capability and split resistance that are labeled and listed to provide fire rating indicated.
 3. Include composite inner blocking.
- E. Stiles:
 1. Provide manufacturers standard laminated edge construction with improved screw-holding capability and split resistance.
 2. Fire-rated doors: Fabricate stiles from fire-retardant material as allowed by label.
 3. Meeting Stiles where CVR Exit Devices are scheduled: Avoid the use of applied metal channels where label allows fire-retardant material as an alternative.
- F. Rails:
 1. Solid Hardwood or Structural Composite Lumber (SCL).
- G. Cross-banding: Engineered wood or wood-based composite, securely bonded to core.
- H. Composite Inner Blocking:
 1. Material: Composite engineered wood product approved for use in fire ratings indicated.
 2. Provide inner blocking in the following locations:

Inner-Blocking - Locations Required & Minimum Sizes			
Location	Usage	WDMA Designation	Minimum Size
Top Rail	All doors	HB-1	5 IN
Mid Rail	Doors w/ Exit Devices	HB-6	5 IN
Lock Block	All doors (except those w/Exit Devices)	HB-4	5 x 18 IN
Stile Block	Doors w/ Flushbolts or Pivots	HB-7	5 IN
Bottom Rail	All doors	HB-2	5 IN

General Notes:

Other Locations and Sizes: Provide additional Inner Blocking as required for Hardware devices Scheduled

3. Provide inner blocking at both surface-applied hardware AND thru-bolted hardware.

2.4 DOORS WITH TRANSPARENT FINISH – PREMIUM GRADE

- A. General:
 1. Utilize WDMA “Premium Grade” criteria except as modified below.
 2. Veneer Thickness: 1/50 IN at 12% moisture content.
 3. Veneer Grade: HPVA Grade “A”.
- B. Veneer Species (both faces unless otherwise noted):
 1. Select White Maple.
- C. Veneer Cut:
 1. Plain Sliced.
- D. Veneer Leaf Match:
 1. Book match.
- E. Face Assembly Match:
 1. Running.
- F. Door-to door Match: Match Pairs and sets.
- G. Door Vertical Edges: Same species as face, no joints.

2.5 MISCELLANEOUS ITEMS

- A. Metal Stile Channels:
 1. Description: Nominal 5 IN metal edge channels at fire-rated pairs equipped scheduled to receive Concealed Vertical Rod (CVR) Exit Devices.
 2. Usage: Use only where fire-retardant wood stiles alone are insufficient to satisfy label.
 3. When Metal Stile channels are necessary:
 - a. Material / Finish: Steel / w/ Wood Veneer overlay, finished to match door.
 - b. Concealed Intumescent Seals: Include where required by fire label.
 - c. Include overlapping metal astragal lip where opening is part of a Smoke Barrier.
- B. Overlapping Astragals:
 1. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00, Hardware.

2.6 FABRICATION

- A. Factory-fit doors to suit frame openings, with the following uniform clearances (comply with most stringent criteria):
 1. NFPA 80 for fire rated doors.
 2. Locally adopted Building Code.
 3. WDMA prefit clearances for factory-fit doors.
 4. Manufacturers hardware templates.
 5. ANSI A250.8.
 6. Door to Frame Clearances Table:

Door To Frame Clearances Table		
Rated / Non-rated	Location	Wood Doors
Rated Openings	Top Rail to Frame	3/32 to 1/8 IN
	Lock Stile to Jamb	

	Hinge Stile to Jamb	
	Meeting Stiles at Pair Doors	1/16 to 1/8 IN
	Face of door to face of Stop	
Door Bottom to Floor / Flooring	Typical; all floor covering types	Up to 1/2 IN
	At Non-combustible Sills	Up to 3/8 IN
	Bare floors; No flooring or sills	Up to 3/4 IN
Non-rated Openings	All Conditions	Comply with criteria listed for rated openings

- B. Factory-machine doors for hardware that is not surface-applied.
1. Comply with final Hardware Schedules, Frame Shop Drawings, and hardware templates.
 2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 3. Factory pre-drill pilot holes for surface-applied items.
- C. Openings and Cut-outs:
1. Make cutouts accurately and neatly.
 2. Provide two sets of glazing stop moldings for openings to completely cover cut edges.
 - a. Neatly miter stops at corners.
 3. Cut and trim openings through doors to comply with applicable requirements of referenced standard for kinds of doors required.
 4. Fill nail holds in wood stops.
- D. Top and Bottom Edges:
1. Render top and bottom edges smooth, non-absorptive and readily cleanable.
 2. SCL rail finish: Make smooth with the application of veneer tape, plastic laminate or clear sealer to finish rough or porous edges.
- E. Fire Labels:
1. Affix permanent labels to fire rated units in accordance with agency requirements.
 2. On openings where continuous hinges, or other items which would conceal label, are scheduled: Locate labels on alternative locations as allowed by listing agency and local authorities.
- F. Vertical Door Edges:
1. Lock Stile Edges: Beveled 1/8 IN per 2 IN.
 - a. Exception for Inactive Leaves: Fabricate inactive leaves with a square edge at the lock stile edge. Active leaves to be beveled per above.
 2. Hinge Stiles Edge: Beveled 1/8 IN per 2 IN.
 3. Exceptions for Double-Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles.

2.7 FACTORY FINISH

- A. General:
1. Comply with WDMA finish requirements.
 2. Completely pre-finish doors at factory.
- B. Transparent Finish Systems:
1. Stain (STN):
 - a. Type: Manufacturer's standard type.
 - b. Stain Color:
 - 1) To be selected by Architect from Manufacturer's standard line.
 2. Transparent Finish Coat:
 - a. System WDMA TR-6 Catalyzed Polyurethane.
 - b. Sheen: 30 to 40.

2.8 ACCESSORIES

- A. Glazing Stops:
 - 1. General:
 - a. Select assemblies which are certified for fire ratings indicated.
 - b. Select assemblies which are physically compatible with glazing type indicated.
 - 2. Stop Material, Rated and non-rated Doors:
 - a. Flush, wood veneer-clad extrusions.
 - b. Core Material: Extruded PVC or approved composite material.
 - c. Species, grain and finish of Wood Veneer Cladding: Match face veneer of doors.
 - d. Profile: Flush with face of door; no projecting lip.
 - e. Match profile of W-6 by Marshfield.
 - f. Exception: Matching solid hardwood stops may be substituted at non-fire-rated openings. Same species or compatible species with door facing.
- B. Field Glazing:
 - 1. Glass: Specified in Section 08 81 04.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine doors and installed frames before hanging doors.
 - 1. Verify suitability of openings to accept installation.
 - 2. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.
 - 3. Do not hang doors in frames which are set out of plumb, out of square, or out of parallel until condition is rectified.
 - 4. Work with frame installer and wall installer to correct misalignment issues.
- B. Verify that wood doors have been properly conditioned to ambient conditions, and with in temperature and humidity levels recommended by manufacturer.
- C. Verify that door warp shall not exceed values prescribed by performance standard specified above.
 - 1. Refer to WDMA I.S.1-A - 2004.
- D. Reject doors with defects prior to hanging.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.
- F. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Installation of wood doors to comply with WDMA IS 1A, door manufacturer's specific instructions, NFPA 80, Building Code as locally adopted.
 - 1. Manufacturer's written instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 2. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- B. Factory-finished doors to be installed just prior to substantial completion.
- C. Do not hang damaged, warped, stained, defective or otherwise damaged doors.
- D. Pilot holes to be drilled for screws attaching hinges, closers, lock hardware and all other devices to the stile or face of door.
 - 1. Pilot hole diameter shall not exceed 90 percent of the root diameter of the screw.
- E. Fit doors to frames and machine for hardware, to extent not previously worked at factory.
- F. Install doors in accordance with manufacturer's instructions.

- G. Glazing Stops:
 - 1. Finish as appropriate for material and type:
 - a. Veneer-wrapped Stops: Finish to match face veneer on doors.
 - b. Solid Wood Stops: Finish to match face veneer on doors.
 - c. Metal Stops: Paint in color to be selected by Architect.
 - 2. Fill nail holds in wood and wood clad stops.
- H. Paint ferrous metal astragals and lock stile plates in color to be selected by Architect.
 - 1. Do not Paint Stainless Steel Items.
 - 2. VOC content of paint shall be no more than 250 g/L.
- I. Hardware: For installation, see Section 08 71 00 / Door Hardware.

3.3 ADJUSTING

- A. Adjust for proper fit and uniform clearance.
 - 1. Operation: Adjust all doors to swing and operate freely.
- B. Align all doors for uniform clearance at each edge.
- C. Adjust and check each door to insure proper operating and function.
- D. Ensure that all fire labels are intact, and readily visible.

3.4 PROTECTION

- A. Protect installed items from dirt, moisture and physical abuse by subsequent trades.

3.5 REPAIRS

- A. Prior to Final Occupancy: Repair or replace damaged items at discretion of Architect.
 - 1. Restore finish before installation if fitting or machining is required at Project site.
 - 2. Replace or re-hang doors which are warped, twisted, or which are not in true planes.
 - 3. Replace or re-hang doors which are hinge bound and do not swing or operate freely.
 - 4. Replace doors which are damaged prior to occupancy.

END OF SECTION

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SECTION 08 31 16
ACCESS PANELS AND DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Access Panels and Doors, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Provide where indicated:
 - 1. Architectural: See architectural drawings.
 - 2. Mechanical: Provided by Mechanical, See Section 20 05 00.
 - 3. Electrical: Provided by Electrical, See Section 26 00 10.
- D. Where not indicated in drawings, provide access panels and/or doors at walls, and inaccessible ceilings as required to permit access to equipment, devices and piping requiring service, adjustment, or inspection.
 - 1. Mechanical: See Section 20 05 00.
 - 2. Mechanical: See Section 20 05 10.
 - 3. Electrical: See Section 26 00 10.

1.2 QUALITY ASSURANCE

- A. Fire rated construction:
 - 1. Provide in fire rated walls, floors and ceilings.
 - 2. UL listed.

1.3 SUBMITTALS

- A. Product data:
 - 1. Technical data on each type of access panel and/or door.
- B. Shop drawings:
 - 1. For review of Contractor selected locations.
 - a. Wall elevations.
 - b. Ceiling plans.
- C. Contract Closeout Information:
 - 1. Warranty.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 WARRANTY

- A. Manufacturer's standard one (1) year warranty covering repair or replacement resulting from defects in material or workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Access panels:
 - 1. Base:
 - a. Milcor.
 - 2. Optional:
 - a. JL Industries.
 - b. Nystrom.
 - c. Karp Associates.
 - d. Williams Brothers.
 - e. Acudor Products, Inc.
 - f. Ventfabrics.
- B. All panels for project by same manufacturer.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 ACCESS DOORS PANELS AND FRAMES – GENERAL

- A. General:
 - 1. Size:
 - a. As required to allow access, inspection, service, and removal of items served.
 - b. Minimum 18 x 18 IN.
 - 2. Non-fire rated:
 - a. Door panels: Minimum 14 GA steel
 - b. Frame: Minimum 16 GA steel.
 - 3. Fire rated construction:
 - a. Provide in fire rated walls, floors and ceilings.
 - b. UL listed.
 - c. Minimum 20 GA steel door, factory primed.
 - d. Sandwich type door filled with insulation.
 - e. 1-1/2 HR (B) fire rating.
 - f. Automatic door closing system.
 - 4. Latching Mechanism:
 - a. Cylinder-operated steel cam lock with 2 keys; all units keyed alike.
 - 1) Exception: Standard screwdriver slotted cam locks may be used at units that are installed 90 IN or higher above floor or walking surface when measured to the centerline of latching mechanism.
 - 5. Finish:
 - a. Factory-primed.
 - b. Paint in field: Specified in Section 09 91 13 for exterior units and 09904 for interior units.
 - 6. Access doors, panels, and frames in ductwork: See additional requirements in Section 23 31 13.
 - 7. Use of lighting fixtures for access in lieu of access panels is not acceptable.

2.3 ACCESS DOOR TYPES

- A. Style and type as required for wall or ceiling materials in which installed.

- B. Flush Access Doors installed in gypsum wallboard walls and ceilings:
 - 1. Provide units with galvanized wallboard taping flange to be embedded in wallboard construction. Units to have a trimless final appearance when installation is complete.
- C. Flush Access Doors installed in concrete, masonry and tile walls and ceilings:
 - 1. Provide units with exposed trim flange having a nominal face width of 3/4 IN or less, Paint trim to match door.
 - 2. Install with adjustable metal masonry anchors.

2.4 FABRICATION

- A. General:
 - 1. Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces:
 - 1. For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes.
 - 2. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames:
 - 1. Grind exposed welds smooth and flush with adjacent surfaces.
 - 2. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- D. Latching Mechanisms:
 - 1. Furnish number required to hold doors in flush, smooth plane when closed.
- E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

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SECTION 08 36 15
SECTIONAL STEEL DOOR (SSD)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Sectional Steel Door (SSD), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Coordinate electrical work with Electrical Specification Divisions.
- B. Verify structural door framing for acceptability.

1.3 SUBMITTALS

- A. Shop Drawings.
- B. Color Samples.
- C. Contract Closeout Information:
 - 1. Operating and maintenance data.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Sectional Steel Overhead Doors:
 - 1. Base:
 - a. Clopay.
 - 2. Optional:
 - a. Overhead Door.
 - b. McKee Door.
 - c. Raynor.
 - d. Wayne Dalton North American.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Sectional Doors - General:
 - 1. Sizes indicated.

2. Design Exterior doors to meet the greater of the following:
 - a. Wind Pressures listed on Design Requirements on Structural Drawings.
 - b. Wind pressures defined by Building Code as locally adopted and amended.
 - c. Design wind load pressure: 20 PSF minimum.
- B. Sectional Steel Doors - Insulated, (SSD-I):
1. Sandwich construction, nominal thickness: 2 IN.
 2. Outside: Flush face, formed of minimum 20 GA G60 galvanized steel.
 3. Inside: Minimum 20 GA galvanized steel interior face sheet.
 4. Core: Polystyrene (or polyurethane) with minimum thermal value: R-9.
- C. Seals:
1. Weatherstrip on bottom:
 - a. Motorized doors:
 - 1) Interior: Flexible neoprene safety edge.
 - 2) Exterior: Combination electric safety edge, weatherseal.
 - b. Non-motorized doors:
 - 1) Exterior: Manufacturer's standard weatherseal.
 - 2) Interior: Neoprene edge to protect floor surface.
 2. Weatherstrip on top and sides:
 - a. Exterior Doors: Adjustable neoprene seal strip.
 3. Maximum air infiltration at exterior doors: Maximum 1 CFM/FT of perimeter.
 4. Finish: Parts galvanized, panels and hood primed with finish coat of baked on enamel, color as selected.
- D. Track:
1. Type:
 - a. Configuration as indicated.
 2. Manufacturer's standard, heavy duty, G90 galvanized.
 3. Mount on inside face of wall.
- E. Torsion springs counterbalance:
1. Helical coil-springs rated at 100,000 cycles.

2.3 OPERATION -MOTORIZED

- A. Operation: Motor operated.
1. Opening rate: Nominal 1 FPS.
 2. Operator:
 - a. UL listed 1/3 HP minimum, 120/1/60.
 3. Gear reduction.
 4. Solenoid braking.
 5. Limit switches for upper and lower limits of travel.
 6. Magnetic relay contactor.
 7. Overload protection.
 8. Pre-wiring to terminal block.
 9. Infrared Safety:
 - a. Include sending and receiving units on opposing jambs, near floor.
 - b. Device to stop descending curtain and reverse motor when object is in beam path.
 10. Electric Safety Edge:
 - a. Causes grille to stop and reverse when an obstruction is encountered when closing.
 11. Back-up operation:
 - a. Manual Push-up.
 - b. Force required: Not to exceed 35 LBS.
 12. Controls:
 - a. Key activated, flush mounted, 3 pushbutton control.
 - b. Operation:

- 1) OPEN button to fully open grille when button is depressed (momentary contact).
 - 2) CLOSE button to close grille when button is depressed (momentary contact).
 - 3) STOP button stops grille in either direction (momentary contact).
 - c. Interlock motor so that CLOSE button will be deactivated when grille is in full down position and OPEN button will be de-energized when grille is in full open position.
 - d. Electronic interlock, which discontinues the motor operator when it senses that the curtain has been secured by mechanical locking device.
 - e. Install 1 per door opening where directed by Architect.
13. Locking at motorized units:
- a. Primary:
 - 1) Locking by motor operator's brake and gear drive.
 - b. Secondary:
 - 1) Cylinder lock on bottom bar.
 - a) Cylinder(s) as specified in Section 08 71 00.
 - 2) Electric interlock with locking device to prevent operation of motor when manual lock device is engaged.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate and opening to accept installation.
- B. Installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION

- A. By manufacturer or authorized representative.
- B. Provide required mounting and accessory items for complete installation.
- C. Prior to occupancy, adjust door for smooth operation and specified weather and air sealing.

END OF SECTION

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SECTION 08 41 26
ALL-GLASS DOOR ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all All Glass Door Entrances, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Tempered glass doors complete with metal fittings and matching hardware.
- D. Adjacent fixed glass with metal frames matching door fittings.

1.2 QUALITY ASSURANCE

- A. Manufacturer qualifications: Single firm with minimum 5 years successful experience in the fabrication of glass doors with adjacent fixed glass units of types required for this project.
- B. Installer qualifications: Authorized or approved by manufacturer for installation of types of units required for this project.
- C. Glass standards:
 - 1. ASTM-C1048 for material.
 - 2. Consumer Product Safety Commission (CPSC) 16 CFR Part 1201 for safety glazing standards.
- D. Metal standards:
 - 1. ASTM-B221 for aluminum extrusions.
- E. Hardware standards: ANSI-A156 series.
- F. Glazing sealant standards.
 - 1. ASTM-C920 for material.
 - 2. ASTM-C719 for test requirements.
- G. Glass door performance standard: ASTM-E330 for test requirements.
- H. Provide openings, embeds, built-ins and other provisions in adjacent work for timely installation of glass door assemblies.

1.3 SUBMITTALS

- A. Shop Drawings:
 - A. Product Data:
 - 1. Manufacturer's product literature.
 - 2. Standard fabrication details, finishes, hardware, and accessories.
 - B. Glass door elevations and details.
 - C. Door hardware schedule.
 - D. Fixed glass plans, elevations and details.
 - E. Samples:
 - 1. Metal and hardware finishes.
 - 2. Tempered glass with fired-on ceramic frit.
 - F. Contract Closeout Information:

1. Warranty.
 2. Maintenance data.
- G. LEED Information:
1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.

1.4 WARRANTY

- A. Manufacturer's standard one (1) year warranty covering repair or replacement resulting from defects in material, workmanship or performance.

1.5 JOB CONDITIONS

- A. Actual dimensions shall be determined by field measurement before fabrication of glass door assemblies or, where field measurements would delay project work, fabrication and adjacent work shall be coordinated to include tolerances to ensure proper fit of glass door assemblies complete with fittings, frames, hardware and adjacent work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

- A. Glass Swing Door Assemblies:
1. Base:
 - a. Blumcraft of Pittsburgh.
 2. Optional:
 - a. Inkan Glass and Architectural Metal.
- B. Glass Sliding Door Assemblies:
1. "Eclipse Standard" system by Avanti Systems USA
 2. Or Equal.
- C. Glazing Channels and Gaskets:
1. C. R. Lawrence.
 2. Or Equal.
- D. Other Manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Tempered Glass:
1. Complying with CPSC 16 CFR Part 1201 for Category II materials, "Safety Standard for Architectural Glazing Materials".
 2. ASTM-C1048, Kind FT, Condition A. Type I. Quality q3.
 - a. Class 1 (clear).
 - b. Thickness: 1/2 IN.
 3. Frit pattern:
 - a. Description: Fired-on, ceramic silk screen frit.
 - b. Patterns as indicated.

- c. Color: White.
 - d. Consistent opacity.
- B. Glazing Sealant:
- 1. Single component elastomeric silicone.
 - 2. ASTM-C920, Type S, Grade NS, Class 25, Uses G, A and O, non-acid curing.
 - 3. Withstands minimum 50% increase or decrease of joint width as tested in accordance with ASTM-C719.
 - 4. Non-yellowing.
 - 5. Sealant shall have a VOC content no greater than 250 g/L.
- C. Fixed Glass Glazing Channels:
- 1. Floor and ceiling/soffit for 1/2 IN (12mm) glass: CRL Wet Glaze U-Channel.
 - 2. Countertop and ceiling/soffit for 1/4 IN (6 mm) glass: CRL Glass Channel. No.D631.
 - 3. Finish: Satin aluminum.
- D. Aluminum Extrusions:
- 1. ASTM-B221.
 - 2. Alloy and temper for intended use and finish application, and not less than the strength and durability of 6063-T5.
 - 3. Types required for installation and mounting of doors and operation of doors.
 - 4. Clear Anodic Finish:
 - a. AA-M10C22A41.

2.3 HARDWARE

- A. General:
- 1. Heavy-duty units required for operation of door.
 - 2. Hardware and hardware sets shall comply as specified in Section 08 71 00, with sets located as scheduled in Section 08 06 00.
- B. Concealed Floor Closers:
- 1. Comply with ANSI-A156.4.
 - 2. Opening Force:
 - a. Adjustable from 5 to 8-1/2 LBS.
 - b. Comply with ADA requirements.
 - 3. Sized for weight of door.
 - a. Type C0612, double-acting.
 - 4. Positive dead stop at 90 to 105 degrees.
 - 5. Delayed - action closing.
 - 6. Inclusive of bottom arm, recessed cement case and metal floor plate.
 - a. Floor plate: Mill finished aluminum.
 - 7. Base Product: "BTS Series" by Dorma.
- C. Top Pivots:
- 1. Compatible with floor closer, mounted in transom frame.
- D. Overhead Door Stops:
- 1. Mounted in transom frame.
- E. Push/Pull Handles:
- 1. Design: Matching compatible bar design with back-to-back through-glass concealed end fastenings, and cylinder locking.
 - 2. Configuration(s):
 - a. Single one-way swing doors: Combination deadbolt and latchbolt in center housing, key outside and thumbturn inside, with strike at jamb.
- F. Sound Gaskets:
- 1. Replaceable resilient compression inserts.

2. Molded neoprene or polyvinylchloride or woven nylon.
 3. Mortise mounted in metal frame members.
- G. Thresholds:
1. Provide thresholds and weatherstripping for exterior doors.
 2. Thresholds:
 - a. Type to allow for latching and other operating requirements.
 - b. Material:
 - 1) Mill finished aluminum.
- H. Weatherstripping:
1. Provide thresholds and weatherstripping for exterior doors.
 2. Sweep type.
- I. Hardware finishes, unless otherwise indicated:
1. General:
 - a. ANSI-A156.18.
 2. Matching clear anodized aluminum finish, US28:
 - a. Brass and bronze: Code 619 (US 15).
 - b. Aluminum: Code 628.
 - c. Stainless steel: Code 630 (US 32D).

2.4 MISCELLANEOUS

- A. Fasteners and Anchors:
1. Conceal where practical or, where exposed, with fastening heads finished to match adjacent metal finish.
 2. Aluminum, non-magnetic stainless steel or other non-corrosive metal compatible with items being fastened.
 3. Protect dissimilar metals to prevent corrosion.
- B. Reinforcements and Brackets:
1. Conceal units of matching metal or steel with hot-dip zinc coating complying with ASTM-A123 applied after fabrication.
 2. Dissimilar metals separated with bituminous paint or preformed separators that prevent corrosion.
 3. Size reinforcements and brackets for performance requirements and for support to adjacent construction.

2.5 FABRICATION

- A. Complete fabrication, finishing, hardware application and other assembly work to the extent practical before shipment to the project site.
- B. Fabricate tempered glass assemblies complete with metal fittings, accessories, fastenings and anchors required for installation and operation.
1. Sizes and dimensions, shapes and profiles not established by specified manufacturer's products shall comply as indicated on the drawings.
 2. Fittings, including rails, hardware housings, and frames shall be reinforced for support and for connection to adjacent construction.
 3. Connecting metal members shall be hairline fitted, with planes and angles in accurate smooth relationships providing continuity of line.
 4. Holes and other cutouts in glass for fittings, hardware or fastenings: Fabricate before glass is tempered.
- C. Select, design and fabricate Glass Door Assemblies to withstand minimum uniform pressures of 20 PSF applied inward and applied outward, as tested in accordance with ASTM-E330.
- D. Complete cutting, fitting, forming, welding, drilling and grinding of metal work prior to final finishing.

1. Remove arises from cut edges, and ease edges and corners to radius of 1/64 IN.
2. Weld by methods recommended by AWS to avoid discoloration.
3. Grind exposed welds smooth and restore mechanical finish to result in uniform final finishing with adjacent surfaces, without evidence of welding.
4. Provide for secure attachment and support at mechanical joints.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine areas, substrates and conditions where glass door assemblies are to be installed.
- B. Correct detrimental substrates and conditions.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Comply with manufacturer's installation recommendations.
- B. Set units plumb, level and true to line, and without warp or rack.
 1. Anchor securely in place.
 2. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- C. Set fixed glass units accurately with butt joints filled with sealant uniformly finished.

3.3 ADJUST AND CLEAN

- A. After repeated operation of completed installation for minimum 100 cycles, readjust door hardware for optimum operating condition and safety.
 1. Lubricate operating equipment.
 2. Clean hardware surfaces.
- B. Remove soiling and other foreign substances from glass door assembly surfaces.
 1. Remove excess glazing sealant.

END OF SECTION

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SECTION 08 44 13
CURTAIN WALL SYSTEMS (CWS) (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Curtain Wall Systems (CWS), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Fabrication, erection and finishing standards: Applicable standards of AA, AAMA and AWS.
- B. Welding and welders:
 - 1. Utilize skilled and qualified welders, licensed where required in accordance with local building regulations.
 - 2. Perform welding in conformance with AWS structural welding code.
- C. Manufacturer shall provide technical field representation at project site at beginning of curtain wall installation, at testing of mock-up, and at least one additional site visit if determined to be necessary by Contractor, Owner, or Architect.
- D. Installer: Certify Manufacturer approval of installer for both shop fabrication quality control and field installation.

1.3 DESIGN CRITERIA

- A. Provide engineering design performed and sealed by registered Structural Engineer (SE), licensed in the State of Illinois.
 - 1. Design Curtain Wall System to satisfy requirements of applicable building codes.
- B. Framing and anchorage design:
 - 1. Expansion and contraction, caused by changes in surface temperature equal to ΔT (delta T).
 - a. ΔT for this project: 165 DegF.
 - b. Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.
 - c. Operating windows and doors shall function normally over this temperature range.
 - 2. Structural movements of building structure:
 - a. Inter-story drift caused by wind or earthquake forces.
 - 1) $h/500$.
 - b. Live load deflection of the supporting members.
 - 1) Span of 33'-0" or Greater
 - a) Live Load: 1/2 IN Maximum
 - b) Long term + Live Load: $L/480$ or 1 IN Maximum
 - 2) Span at East & West Curtain walls
 - a) Live Load: 3/8 IN Maximum
 - b) Long term + Live Load: $L/480$ or 1/2 IN maximum
- C. Primary Seal at Perimeter:
 - 1. Locate inboard of back plane of glazing pocket.
- D. Drainage:
 - 1. Design Curtain Wall System to intercept, collect, contain, and drain water (which may infiltrate system) harmlessly to exterior.

- E. Attachment of interior window treatments:
 - 1. Where interior window blind systems are not capable of spanning from wall to wall, the blind system will be anchored into the inside face of the horizontal mullions of the curtain wall system.
 - 2. It shall be a requirement of this project that the curtain wall Manufacturer and installer provide confirmation that such attachment will not void or otherwise limit or alter the curtain wall warranty.
- F. Mock-up Wall:
 - 1. Erect a Mock-up Wall 2 bays wide and 2 stories high.
 - a. Install complete with glass, glazing, insulation, spandrels, anchors and other components required to create entire assembly.
 - 2. Mock-up Wall may be retained in place as a permanent part of the building.
 - a. If constructed separate from building, Mock-up Wall shall remain intact during balance of curtain wall installation, and used for comparative purposes.
 - 3. Refer to Section 01 91 13 for testing requirements of mockup wall.
- G. Design Loads:
 - 1. Design Curtain Wall System and anchorage to meet Design Load.
 - a. Use the Greater of the following:
 - 1) Wind Pressures listed on Design Requirements on Structural Drawings.
 - 2) Wind Pressures defined by Building Code as locally adopted and amended.
 - 3) 20 PSF Minimum.
 - b. Limit deflection to values specified for "Uniform Design Load Test".
- H. Design Skylights and/or Sloped Curtain Wall Systems and anchorage to meet Design Load.
 - 1. Wind Load: Use the greater of the following:
 - a. Wind Pressures listed on Design Requirements on Structural Drawings.
 - b. Wind Pressures defined by Building Code as locally adopted and amended.
 - c. 25 PSF Minimum.
 - 2. Snow Load: Use the greater of the following:
 - a. Snow Load listed on Design Requirements on Structural Drawings.
 - b. Snow Load defined by Building Code as locally adopted and amended, including drifting.
 - c. 30 PSF Minimum.
 - 3. Limit deflection to L/175 and allowable stress with a safety factor of 1.65
 - a. Comply with local Building Code where more restrictive.

1.4 TEST REQUIREMENTS

- A. General:
 - 1. Utilize independent testing laboratories specifically qualified to conduct performance tests listed.
 - 2. Submit complete, certified reports.
 - 3. Performance tests may be conducted in manufacturer's laboratories provided they are witnessed and certified by qualified independent testing laboratory personnel.
 - 4. Pre-construction Laboratory Testing .
 - a. Lab Test Reports, indicating compliance with specified criteria must be based on a test unit that accurately represents the product currently being produced for use on subject project.
 - 1) Base and Optional Manufacturers: Test reports may be up to 10 years old.
 - 2) Manufacturers not listed as Base or Optional: Test reports may be up to 5 years old.
- B. Perform Field Testing on Mock-up Wall.
 - 1. Evaluate appearance, anchorage, and weathertightness.
 - 2. Refer to Section 01 91 13 for testing requirements.
 - 3. If unit is not acceptable, modify and/or remove and re-construct new Mockup Wall and retest, until assembly is accepted.

- C. Accepted Mock-up serves as standard of quality for remainder of curtain wall construction.
- D. Structural wind pressure test:
 - 1. Conduct in accordance with ASTM-E330.
 - 2. Apply 1.5 times design wind loads specified.
 - 3. Loads applied shall not cause permanent set in excess of 0.2 percent of unsupported span of aluminum wall members, or result in damage to anchors, fasteners, or other wall components.
- E. Uniform design load test:
 - 1. Conduct in accordance with ASTM-E330.
 - 2. Apply inward and outward test pressures equal to design wind pressures.
 - 3. Result:
 - a. No glass breakage, permanent damage to fasteners, or anchors and main members.
 - b. No permanent deformation in excess of 0.2 percent of clear span.
 - 4. Deflection of framing member in direction normal to plane of wall not exceeding 1/175 of clear span or 3/4 IN whichever is least, except when a plastered surface is subjected to bending, use deflection not exceeding 1/360 of span or 3/8 IN whichever is least. Maximum deflection at cantilevers not to exceed 2L/175.
 - 5. Measure deflection from gauges located on vertical mullions and horizontal members.
 - 6. Deflection of member in direction parallel to plane of wall, when carrying its full dead load, not exceeding an amount which will reduce glass bite below 75 percent of design dimension.
 - 7. Provide minimum 1/8 IN clearance between member and top of fixed panel, glass, or other fixed part immediately below.
 - 8. Clearance between member and operable window or door, minimum 1/16 IN.
- F. Water infiltration test:
 - 1. Test in accordance with ASTM-E331.
 - 2. No uncontrolled water penetration through area of wall.
 - 3. Differential static pressure 20 percent of inward acting design wind load pressure specified but not less than 6.24 PSF.
 - 4. Operable windows: Meet requirements for resistance to water penetration set forth for window types.
 - a. AAMA GS-001.
 - b. Section 08 51 10.
- G. Air Infiltration Test:
 - 1. Test specimens in accordance with ASTM-E283.
 - 2. Maximum Air Infiltration:
 - a. Fixed wall areas: 0.06 CFM/FT² when tested at 6.24 PSF.
 - b. Swinging Doors:
 - 1) Single: 0.50 CFM/FT² when tested at when tested at 6.24 PSF.
 - 2) Pairs: 1.0 CFM/FT² of perimeter crack, when tested at when tested at 1.56 PSF.
- H. Thermal tests:
 - 1. Perform thermal tests on unit sized as required to produce representative areas of framing, vision glass and spandrel glass.
 - 2. Provide "Test Unit" which reflects most restrictive situation on project (i.e. worst framing, glass, spandrel proportions for producing desired thermal results).
 - 3. Submit elevations indicating which areas were selected from project along with calculations verifying test areas are proportional to area selected.
 - 4. Test in accordance with AAMA 1502.7 and ASTM-C1363.
 - 5. Determine results from average of interior surface thermocouple readings.
 - 6. Thermal transmittance of insulated glass areas of wall: Maximum average U-value of 0.65 BTUH/SF/degF.
 - 7. Thermal transmittance of framing areas of wall: Maximum U-value of 0.63 BTUH/SF/degF.

8. Thermal transmittance of insulated spandrel glass areas: Maximum U-value of 0.20 BTUH/SF/ degF.
 9. Average calculated thermal transmittance of composite wall: Calculated U-value of 0.65 BTUH/SF/ degF, with substantiating test performed on similar units.
 10. Condensation resistance test: Determine the CRF values from data obtained on above mentioned thermal test. Provide Condensation Resistance Factor (CRF) not less than:
 - a. CRF 55 for glass.
 - b. CRF 70 for frame.
- I. Test of anodic seal:
1. Perform acid dissolution test on sealed anodized finish.
 2. Perform in accordance with ASTM-B680.
 3. Maximum permissible loss: 2.6 mg/IN².
 4. Furnish certified test report indicating that test was performed on aluminum for this project.
 5. Furnish 1 test for each 50,000 SF of material.

1.5 SUBMITTALS

- A. Project Data.
1. Manufacturer product literature.
 2. Manufacturer's installation guidelines.
- B. Shop drawings:
1. Elevations, sections and details for review of design intent, air and water management, and anchorage to building frame.
 - a. Glazing pocket depth required to meet design requirements.
 - b. Glazing shim block size and spacing.
 - c. Frame attachment.
 - d. Back pan attachment and seal.
 - e. Weep locations.
 - f. Gasket gages where air barrier, waterproofing, and roofing system transition flashing is captured by pressure plates.

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- g. Integration of coping into curtain wall systems.
- C. Samples:
1. Range samples of aluminum finishes.
- D. Project information:
1. Structural calculations prepared by a registered Engineer (licensed to practice Structural engineering in the state where project is located) made by or for curtain wall manufacturer to verify compliance with contract documents and in connection with supplementary design and detailing of work for review of interface between curtain wall support system and building structural frame.
 2. Certified independent laboratory test reports verifying compliance with performance characteristics.
- E. Contract closeout information:
1. Warranty.
 2. Maintenance data.
- F. LEED Information:
1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.6 WARRANTY

- A. Written two (2) year warranty signed jointly by manufacturer and installer, agreeing to repair or replace work performed under this section which fails.
 1. Failure includes but not limited to, defects in materials, workmanship, water tightness of assembly, caulking, glazing or other defect which affects its ability to perform as a weathertight envelope.
 2. Manufacturer and installer shall permit fastening of interior window treatments to interior face of horizontal mullions without voiding or limiting warranty of curtain wall system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Curtainwall System (CWS):
 1. Base:
 - a. EFCO.
 2. Optional:
 - a. Kawneer
 - b. Oldcastle Glass, Vistawall.
 - c. Wausau Window and Wall Systems.
- B. Other manufacturers desiring approval comply with Section 00 26 00. Submit test reports prior to bid.

2.2 MATERIALS

- A. Base Product:
 1. Curtain Wall:
 - a. EFCO Series 5600 Outside Glazed.
- B. Aluminum Framing and components:
 1. Material Standard: Extruded Aluminum, ASTM-B221, 6063-T5 alloy and temper.
 2. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.
 3. Member Depth and internal reinforcing:
 - a. Comply with frame depths indicated wherever possible.
 - b. Increase depth as required to structural strength necessary to resist Design Loads.
 4. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.
 5. Provide strike boxes at all openings in framing system.
- C. Backpans:
 1. Provide sealed backpans at spandrel locations at floor/ roof slab and spandrel beam conditions where a fire containment system is required.
 2. Seal perimeter of backpan from outside.
 3. Install insulation inside backpan prior to installation of glass unit.
- D. Fasteners:

1. Where exposed, shall be Stainless Steel.
 2. Where concealed: Select material at manufacturer's option, subject to galvanic compatibility with materials being joined.
- E. Gaskets: Glazing gaskets shall comply with ASTM-C864 and be extruded of a silicone-compatible EPDM rubber that provides for silicone adhesion.
- F. Perimeter Anchors: Aluminum.
1. When steel anchors are used, provide isolation material between steel material and aluminum material to prevent galvanic action.
- G. Thermal Barrier: Thermal separator shall be extruded of a silicone-compatible elastomer that provides for silicone adhesion.
- H. Interior Stools and Sill Extensions (aluminum):
1. Aluminum extrusions and associated clips and fasteners.
 2. Pre-finished to match Curtain Wall frames.
 3. Profiles indicated on drawings.

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- I. Copings
1. Aluminum extrusions and associated clips and fasteners.
 2. Pre-finished to match Curtain Wall frames.
 3. Profiles indicated on drawings.
- J. Non-Thermally Broken Doors:
1. Where aluminum doors indicated at interior vestibule locations.
 2. Fabricate of extruded sections assembled with tension rods, or welded corners.
 3. Dimensions:
 - a. Member Wall Thickness: 0.125 IN (minimum).
 - b. Member Depth: 1-3/4 IN.
 - c. Stiles and Top Rail:
 - 1) Narrow:
 - a) 2-1/8 to 2-1/4 IN.
 - b) Base Product: "Series D200 Swing Door, Narrow Stile" by EFCO.
 - d. Bottom Rail: 10 IN.
 4. Include wear shield on bottom rail.
 5. Offset Pivots: Specified in Section 08 71 00.
 6. Provide manufacturer's standard weatherstripping at edges and door bottom.
 7. Prepare and reinforce doors to receive additional hardware specified in Section 08 71 00.
- K. Thermally Broken Doors:
1. Where aluminum doors indicated at exterior wall locations.
 2. Fabricate of extruded sections assembled with tension rods, or welded corners.
 3. Dimensions:
 - a. Member Wall Thickness: 0.125 IN (minimum).
 - b. Member Depth: 2 IN.
 - c. Stiles and Top Rail:
 - 1) Narrow:
 - a) 2-1/4 to 3 IN.
 - b) Base Product: "Series D202 Thermastile Swing Door" by EFCO.
 - d. Bottom Rail: IN.
 4. Include wear shield on bottom rail.
 5. Offset Pivots: Specified in Section 08 71 00.
 6. Provide manufacturer's standard weatherstripping at edges and door bottom.
 7. Provide Threshold.
 8. Prepare and reinforce doors to receive additional hardware specified in Section 08 71 00.
- L. Ventilating Units:

1. Compatible with Curtain Wall System specified.
 2. Provide ventilating sashes where indicated.
 3. No visible frame profile from exterior.
 4. Commercial class:
 - a. C70 where 1 IN IGU glazing units are indicated.
 5. Configuration:
 - a. Project-out, awning.
 6. Omit insect screen.
 7. Hardware:
 - a. 4-bar hinges.
 - b. Omit any locking device that would interfere with automatic motorized actuator operation.
 - c. Motorized actuators
 - 1) Base: Supermaster DC by Functional Fenestration Inc. or equal.
 - 2) Shall have feedback circuit, allowing open and closed status to be monitored.
 - 3) Motorized actuators shall automatically open ventilating units when atrium smoke evacuation system is triggered by the detection of smoke. Actuators at all sashes shall open simultaneously.
 - 4) Provide largest chain stroke capable of operating each sash based upon the dimensions and weight of each sash.
 - a) 37"x64" sash shall have a 31.5" chain stroke minimum.
 - b) 26"x64" sash shall have a 18" chain stroke minimum.
 - c) 64.5"x32" sash shall have a 24" chain stroke minimum.
 - 5) Aluminum case shall be clear or silver anodized.
 - 6) Transformer shall be remotely located in the ceiling and wiring to actuator shall be concealed within the curtain wall framing.
- M. Sealants: See Section 07 92 13.
- N. Glass: See Section 08 81 02.
- O. Perimeter Fire Containment Systems: See Section 07 84 53.
- P. Expansion Joints: See Section 07 95 14.

2.3 FABRICATION

- A. General:
1. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
 2. Accurately fit and secure joints and corners.
 3. Make joints flush, hairline and weatherproof.
 4. Prepare components to receive anchor devices.
 5. Fabricate anchors.
 6. Arrange fasteners and attachments to conceal from view.
 7. All weather/air seals to be complete and continuous.
- B. Weld by methods recommended by manufacturer and AWS to avoid discoloration.
1. Grind exposed welds smooth and restore finish.
- C. Maintain true continuity of line and accurate relation of planes and angles.
- D. Separate dissimilar metals with bituminous paint or preformed separators to prevent corrosion.
- E. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts to permanently prevent freeze-up of joint.
- F. Provide tubular and solid extruded aluminum mullions and horizontal rail shapes with sharp well defined corners and flush sight lines.

- G. Provide means to intercept, collect, contain and weep moisture accumulation harmlessly to exterior.
- H. Reinforce work as necessary for performance requirements, and for support to structure.
- I. Provide continuous solid or semi-rigid vinyl or cast urethane insulating materials to fully separate exterior exposed portions of aluminum from interior portions.
- J. Use no bolts, screws or other hardware components, metallic fastenings, etc. that will impair independent frame movement or thermal barrier effectiveness.
- K. Reinforce doors and frames and hardware.

2.4 FABRICATION SKYLIGHTS AND/OR SLOPED CURTAINWALL

- A. Major framing shall be factory prepared for job site assembly and sealed according to manufacturers recommended procedures.
- B. Rafters and Purlin Members:
 - 1. Integral drainage gutters in both the glazing pocket and inside the glass plane to drain moisture to the exterior.
 - 2. Flexible thermal break material at exterior side of the glass plane.
 - 3. Joints between Rafter and Intermediate Purlins:
 - a. Made without the use of clips.
 - b. Do not locate joint fasteners within the interior drainage gutter.
- C. Structural Silicone Glazed Purlin (where indicated):
 - 1. Minimum width of weather seal joint of silicone: 3/4 IN.
 - 2. Design interior structural joint design to withstand the maximum anticipated combined loads (with 6:1 safety factor).
 - 3. Apply silicone in accordance with sealant manufacturer's recommendations.
 - 4. Insulating glass units shall be of a construction suitable for structural silicone glazing.
 - 5. Completed joint will result in no through-metal or projecting fins exposed to the exterior.
- D. Sill Members:
 - 1. Run continuously past the Rafter Members creating a drainage gutter.
 - 2. Design with weep holes and silicone exterior glazing seal not less than 3/16 IN wide.
 - 3. Fasten aluminum pressure plates to the main grid members.
- E. Interior Glazing Seals:
 - 1. Resilient elastomers installed in the main framing members.

2.5 ANODIC FINISHES

- A. General:
 - 1. Base Product: "Permanodic" by Kawneer.
 - 2. Color consistency range: 5 delta E's.
 - 3. Anodic Finish complying with AAMA 611 and the following:
- B. Clear Anodic finish (Class I):
 - 1. Architectural Class I per AAMA 611.
 - a. 2-step electrolytic.
 - 2. Minimum Coating Thickness: 0.7 mils.
 - 3. Color: "#14", Clear, AA-M12C22-A41.

2.6 SCHEDULE OF CWS TYPES

- A. CWS-1:
 - 1. Generally indicated at the following locations:
 - a. North façade at 2nd and 3rd Floor Levels.
 - b. West façade at 2nd and 3rd Floor Levels (except where CWS-2 is indicated at punched openings).

- c. East façade at all Floor Levels.
 - 2. Base: EFCO Corporation; 5600 Curtain Wall System
 - 3. Profile: 2-1/2 IN sightline x 7.5 IN deep.
 - 4. Outside-glazed.
 - 5. Aesthetic Requirements
 - a. Vertical mullions:
 - 1) Column locations on North Façade:
 - a) Captured w/pressure plate and extended 4 IN snap-on cap where indicated each side of north façade columns.
 - 2) Elsewhere on 2nd and 3rd Floor of North and West Facades:
 - a) Structural silicone-glazed.
 - 3) East Façade:
 - a) Captured w/pressure plate and 3/4 IN snap-on cap.
 - b. Horizontal mullions:
 - 1) Captured w/pressure plate and 3/4 IN snap-on cap where indicated.
 - 2) Structural Silicone-glazed where indicated.
 - 6. Continuous air barrier shall be flashed into glazing pockets at perimeter of curtain wall system using preformed silicone membrane system with extruded aluminum pressure bar fastened and sealed to the curtain wall frame. Refer to Section 07 27 26.
- B. CWS-2:
- 1. Generally indicated at the following locations:
 - a. Punched window conditions at South, East, and West Facades at 2nd and 3rd Floor Levels.
 - 2. Base: EFCO Corporation; 5600 Curtain Wall System
 - 3. Profile: 2-1/2 IN sightline x 6 IN deep.
 - 4. Outside-glazed.
 - 5. Aesthetic Requirements
 - a. 4-Sided SSG.
 - 1) Verticals (including jambs): Structural Silicone-glazed (SSG).
 - 2) Horizontals (including head and sill): Structural Silicone-glazed (SSG).
 - 6. Continuous air barrier shall be flashed into perimeter of curtain wall system using preformed silicone membrane system with extruded aluminum pressure bar fastened and sealed to the curtain wall frame at the perimeter glazing extrusion. Refer to Section 07 27 26.
- C. CWS-3:
- 1. Generally indicated at the following locations:
 - a. North, South, East, and West Facades at 1st Floor Level.
 - 2. Base: EFCO Corporation; 5600 Curtain Wall System
 - 3. Profile: 2-1/2 IN sightline x 6 IN deep.
 - 4. Outside-glazed.
 - 5. Aesthetic Requirements
 - a. Verticals at jambs: Captured w/pressure plate and 3/4 IN snap-on cap.
 - b. Intermediate verticals: Structural Silicone-glazed.
 - c. Horizontals: Captured w/pressure plate and 3/4 IN snap-on cap.
 - 6. Continuous air barrier shall be flashed into glazing pockets at perimeter of curtain wall system using preformed silicone membrane system with extruded aluminum pressure bar fastened and sealed to the curtain wall frame. Refer to Section 07 27 26.
 - 7. Ventilating sashes with motorized actuators shall be provided where indicated. Motorized actuators shall be activated by the atrium smoke detection system.
- D. CWS-4:
- 1. Skylight/sloped curtain wall system.

2. Base: EFCO Corporation; 5600 Sloped Curtain Wall System

PART 3 - EXECUTION

3.1 PRE-INSTALLATION QUALITY CONTROL MEETING

- A. Review shop drawing submittal.
 1. Discuss all project curtain wall requirements.
 2. Discuss framing support and attachment details.
 3. Discuss flashing conditions at all adjacent construction systems.
 4. Discuss finish work at interior.
 5. Discuss spandrel conditions at floor elevations.
 6. Discuss access for installation of perimeter fire containment system.
 7. Discuss glazing methods and types.

3.2 GENERAL:

- A. System Installation
 1. Install Curtain Wall Systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions.
 - a. Provide adequate structural supports and anchor in place.
 - b. Do not create thermal bridge.
 2. Comply fully with manufacturer's shop drawings, erection drawings, and recommendations for installation.
 3. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
 4. Set units plumb, level and true to 1 in 1000 tolerance.
 5. Use nylon or neoprene washers where required to allow for thermal movement.
 6. Separate metal surfaces from sources of corrosion or electrolytic action.
 7. Anchor securely in place.
 8. Install flashing and sealants within and at perimeter with splices and end dams designed and installed to insure weathertight installation.
 9. Prevent air leakage through the interior mullion tubes to the space behind spandrel insulation.
 - a. Manufacturer to incorporate all available features to prevent leakage of air through seams in interior mullion tubes.
 - b. In addition, provide continuous sealant at all corner seams at intersections of all horizontal and vertical mullions.
 10. Integration of transition membranes at perimeter of curtainwall system to maintain a continuous air and water barrier.
 - a. At captured glazing conditions:
 - 1) Provide continuous glazing pocket infill extrusions to provide an attachment point for the adaptor extrusion of the air barrier transition assembly, and to facilitate the capture of transition flashings for adjacent waterproofing systems and roofing systems.
 - 2) Adjust seals as required for differing membrane thicknesses to ensure the capture plate is not tilted when installation is complete.
 - 3) Coordinate with air barrier system, waterproofing system, and roofing system installers.
 - b. At 4-sided structural glazing conditions:
 - 1) Provide continuous perimeter extrusion to protect edge of glazing and to provide an attachment point for the adaptor extrusion of the air barrier transition assembly.
 - 2) Coordinate with air barrier system installer.

AD-4:

11. Coping.

- a. Glazed into head of Curtain Wall system.
- B. Backpan:
 - 1. Install backpans at spandrel beam and slab conditions where perimeter fire containment system is required.
 - 2. Provide continuous sealant around perimeter of backpan prior to installation of insulation.
 - 3. Provide insulation in backpan prior to glazing.
- C. Glazing:
 - 1. General:
 - a. Glass shall be outside-glazed.
 - b. Secure glass to mullions using one or more of the following as indicated.
 - 1) Captured Lites: Mechanically secured in place with extruded aluminum pressure plates.
 - 2) SSG Lites: Glass bonded in place with silicone bonded to aluminum mullions.
- D. Water Drainage:
 - 1. Compartmentalize each light of glass using joint plugs and silicone sealant to divert water to horizontal weep locations.
 - 2. Locate weep holes in horizontal pressure plates and covers to divert water to exterior of building.

3.3 FIELD QUALITY CONTROL

- A. Field Tests - General:
 - 1. Architect shall select Curtain Wall to be tested when representative portion of Curtain Wall has been installed, glazed, perimeter caulked and cured.
 - 2. Test for water penetration in accordance with AAMA 501.2-03, Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
 - 3. Where test results do not meet requirements: Correct deficiencies, and implement improved installation procedures for completing balance of Curtain Wall.
 - 4. Testing to continue on previously installed sections if test fails and again on representative sections after correction of deficiencies at Contractor's expense.
- B. Submit results of all tests to Architect.

3.4 PROTECTION AND CLEANING

- A. Protection:
 - 1. Protect finish surfaces from damage during construction.
 - 2. Protect from damage of grinding, polishing, plaster, lime, acid, cement and other harmful contaminants.
- B. Cleaning:
 - 1. Repair or replace damaged components.
 - 2. Clean in accordance with manufacturer's instructions.
 - 3. Remove construction debris and legally dispose off site.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes:
 - 1. The work in this section includes furnishing all items of finish hardware as hereinafter specified or obviously necessary for all swinging, sliding, folding and other doors. Except items, which are specifically excluded from this section of the specification or of unique hardware, specified in the same sections as the doors and frames on which they are installed.
- B. Work furnished but not installed:
 - 1. Door closers for packaged doors in Section 08 17 00.
 - 2. Cylinders for packaged doors in Section 08 17 00.
 - 3. Magnetic locks for packaged doors in Section 08 17 00.
 - 4. Door Stops for packaged doors in Section 08 17 00.

1.2 QUALITY ASSURANCE

- A. Fire-Rated Door Assemblies:
 - 1. Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- B. Smoke- and Draft-Control Door Assemblies:
 - 1. Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 2. Air Leakage Rate: Maximum air leakage of 3 CFM/FT² at the tested pressure differential of 0.1 IN of water.
- C. Finish designations and standards: Builders Hardware Manufacturers Association (BHMA) Standard 1301.

1.3 QUALIFICATIONS

- A. Installer qualifications: Supervised or inspected by certified Architectural Hardware Consultant (AHC).
- B. Hardware Supplier:
 - 1. Recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years.
 - 2. On-staff, experienced Architectural Hardware Consultant (AHC) who is available, during the course of the Work, for consultation about project's hardware requirements.
 - 3. Hardware supplier must be an authorized factory distributor of all products herein.
- C. Electrified Hardware Supplier:
 - 1. Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design and extent to that indicated for this project, who has a record of successful in-service performance and is acceptable to manufacturer of materials.
 - 2. Shall prepare data for electrified door hardware based on testing and engineering analysis of manufacturer's assemblies similar to those in this project.
- D. Integrated Weigand Supplier Qualifications:

1. Integrated Wiegand products shall be furnished a factory trained, certified and direct purchaser of the automatic operator. Supplier to be a current member of the Power Operator preferred installation program and be equipped with servicing the equipment.

1.4 REFERENCES

A. Standards:

2. ANSI A156.1 – Butts and Hinges
3. ANSI A156.2 – Bored Locks and Latches
4. ANSI A156.3 – Exit Devices
5. ANSI A156.4 – Door Controls – Door Closers
6. ANSI A156.5 – Auxiliary Locks and Associated Products
7. ANSI A156.6 – Architectural Door Trim
8. ANSI A156.7 – Template Hinge Dimensions
9. ANSI A156.8 – Door Controls – Overhead Holders
10. ANSI A156.13 – Mortise Locks and Latches
11. ANSI A156.15 – Closer Holder Release Devices
12. ANSI A156.16 – Auxiliary Hardware
13. ANSI A156.18 – Material and Finishes
14. NFPA80 – Fire Doors and Windows
15. UL10C – Positive Pressure Fire Tests of Door Assemblies

B. Codes:

1. NFPA 101 – Life Safety Code; 2009 Edition
2. IBC 2009 – International Building Code
3. ANSI A117.1 – Accessible and Usable Buildings and Facilities

1.5 SUBMITTALS

A. General Requirements:

1. Submit copies of finish hardware schedule in accordance with Division 1, General Requirements. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

B. Shop Drawings:

1. Complete Hardware Schedule and Product Data by door.
 - a. Complete list of products including model numbers and cut sheets.
 - b. Hardware Schedule shall utilize Heading Numbers which are logically derived from Architect's Hardware Set numbers.
 - c. Schedules to be in vertical format, listing each door opening, and organized into "hardware sets" indicating complete designations of every item required for each door opening to function as intended. Note any special mounting instructions or requirements with the hardware schedule. Schedules to include the following information:
 - 1) Location of each hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
 - 2) Handing and degree of swing of each door.
 - 3) Door and frame sizes and materials.
 - 4) Keying information.
 - 5) Type, style, function, size, and finish of each hardware item.
 - 6) Elevation drawings and operational descriptions for all electronic openings.
 - 7) Name and manufacturer of each hardware item.
 - 8) Fastenings and other pertinent information.
 - 9) Explanation of all abbreviations, symbols and codes contained in schedule
 - 10) Mounting locations for hardware when varies from standard.

- d. Hardware Sets shall follow the guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule with index of doors and headings, indicating complete designations of every item required for each door or opening.
 2. Diagrammatic Elevations and Point-to-Point Wiring Diagrams of openings scheduled to receive electrified hardware and electronic access control devices.
 - a. Submit with Hardware Schedule.
 3. Submit catalog cuts and/or product data sheets for all scheduled finish hardware.
 4. Submit separate detailed keying schedule for approval indicating clearly how the owner's final instructions on keying of locks has been fulfilled.
- C. Samples:
1. Upon request, samples of each type of hardware in finish indicated shall be submitted. Samples are to remain undamaged and in working condition through submittal and review process. Items will be returned to the supplier or incorporated into the work within limitations of keying coordination requirements.
- D. Templates:
1. Furnish a complete list and suitable templates, together with finish hardware schedule to contractor, for distribution to necessary trades supplying materials to be prepped for finish hardware.
- E. Electronic Hardware Systems:
1. Provide complete wiring diagrams prepared by an authorized factory employee for each opening requiring electronic hardware, except openings where only magnetic hold-open devices are specified. Provide a copy with each hardware schedule submitted after approval.
 2. Provide complete operational descriptions of electronic components listed by opening in the hardware submittals. Operational descriptions to detail how each electrical component functions within the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval.
 3. Provide elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval.
 4. Prior to installation of electronic hardware, arrange conference between supplier, installers and related trades to review materials, procedures and coordinating related work.
 5. The electrical products contained within this specification represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the distributor to bear the cost of providing a complete and working system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with electrical engineer and electrician to ensure that line voltage and low voltage wiring is coordinated to provide a complete and working system.
 6. For each item of electrified hardware specified, provide ElectroLynx standardized plug connectors to accommodate up to twelve (12) wires. Plug connectors shall plug directly into ElectroLynx through-door wiring harnesses, frame wiring harnesses, electric locking devices and power supplies.
- F. Project Information:
1. Certification that items bear UL label where required.
 2. Meeting minutes from Pre-Installation Conference.
- G. Contract Closeout Information:
1. Schedule of all components installed as hardware sets for each opening.
 2. Operating and maintenance data.
 - a. Parts catalog for each product furnished.
 - b. Keying records.
 3. Owner instruction report.
 4. Letter stating extra material has been delivered.

1.6 FIRE-RATED OPENINGS

- A. Provide door hardware for fire-rated openings that comply with NFPA80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.
- B. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
 - 1. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Tag or package each item identified to hardware schedule.
- B. Include installation instructions.
- C. Deliver hardware items at times and to locations as directed.
- D. Check hardware against schedule, reorder missing items.
- E. Control items before and after installation so completion will not be delayed by hardware losses.
- F. Protect finishes by temporary coverings as required.
- G. Deliver extra hardware to Laboratory, boxed and identified.
- H. Deliver all keys: master, sub-master and change keys, to Laboratory Lockshop via certified mail or Fed Ex with delivery confirmation.

1.8 PRE-INSTALLATION CONFERENCE

- A. Prior to installation of hardware, Construction Manager/Contractor conduct an on-site meeting to instruct hardware installer personnel in the proper installation of hardware and related electronics.
 - 1. Manufacturer's Reps for Locksets, Closers, Exit Devices and other major hardware devices shall be present and direct instruction of installers.
 - 2. Require attendance of affected parties, not limited to: Construction Manager/Contractor, Hardware installer, Electrical installer, door and frame installers, and security installer (where applicable).
 - 3. Discuss installation sequence of components, Point-to-Point wiring diagrams, and address questions raised by installers.

1.9 JOB CONDITIONS

- A. Coordinate installation with finishing operations.
- B. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical as the same operation and quality as type specified, subject to Architect's approval.

1.10 WARRANTY

- A. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one (1) year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to the owner.
 - 1. Mortise locksets: Five (5) years
 - 2. Exit Devices: Five (5) years
 - 3. Door closers: Ten (10) years
 - 4. Securitron (and approved equals) electrified hardware: Lifetime

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Only manufacturers as listed below shall be accepted. Obtain each type of finish hardware (hinges, latch and locksets, exit devices, door closers, etc.) from a single manufacturer.

2.2 HARDWARE – GENERAL

- A. General:
 - 1. Provide hardware for fire rated openings in compliance with UL, NFPA-80 and CFR Part 36 (ADA) guidelines.
 - a. This requirement takes precedence over other requirements for such hardware.
 - b. Provide only hardware which has been tested and listed by UL for types and sizes of doors.
 - 2. Furnish items of hardware for proper door swing.
 - 3. Provide extended lips when necessary.
 - 4. Provide strike boxes.
 - 5. Tactile Warning:
 - a. Definition: Etched, milled or knurled surface treatment used on Levers to warn occupants, especially vision impaired occupants, of a potentially dangerous room or condition beyond door.
 - b. Provide on corridor-side levers of doors to loading platforms, boiler and mechanical rooms, stages, utility stairs, roof access, communications and electrical closets and similar rooms.
 - 6. Provide dustproof strikes for doors with Flushbolts or other bolts to floor.
 - 7. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.
- B. Templates:
 - 1. Provide templates to door and frame suppliers.
 - 2. List template numbers on Hardware Schedule submittal for use by fabricators.
 - 3. Provide copies of approved Hardware Schedule to related suppliers, fabricators, and installers.
 - 4. Include numbered templates.
 - 5. Advise Architect of items which will not operate properly, attain the required fire label, and where components are physically/functionally incompatible.
- C. Finishes:
 - 1. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products.
 - 2. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
 - 3. Where specified provide factory applied Silver Ion antimicrobial finish. Field or shop applied coatings are not acceptable.

Hardware Finishes				
Hardware Component	Satin Chrome Series			
	Base Metal	ANSI / BHMA	Finish Description	US Equiv
Locksets and Latchsets	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Door Pulls, Pushbars, and Pushplates	Stainless Steel	630	Satin Stainless Steel	US32D
Kickplates and Armorplates	Stainless Steel	630	Satin Stainless Steel	US32D
Exit Devices	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Hinges	Stainless Steel	630	Satin Stainless Steel	US32D
	Steel	652	Satin Chromium plated over nickel	US26D
Thresholds, Weatherstripping, Head Drips	Aluminum	719	Mill finish aluminum	US27
Door stops, holders, dead locks, mortise bolts, pivots, door Edging and miscellaneous hardware	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Patient Latches	Stainless Steel	630	Satin Stainless Steel	US32D
Exposed arms and covers of closers:	Any	689	Powder Coated Aluminum Color	US20A

D. Fasteners:

1. Manufacture hardware to conform to templates.
2. Generally prepare for Phillips oval head machine screw installation.
3. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
4. Mineral core doors:
 - a. Attachment of hinges:
 - 1) Use screws, which are fully threaded (from tip to head).
 - b. Attachment of Closers:
 - 1) Utilize through-bolts at mineral core doors.
5. Provide concealed fasteners (unless thru bolted).
6. Provide non-corrosive fasteners.

2.3 HANGING DEVICES

A. Hanging Devices:

1. Butts and Hinges
 - a. Acceptable Manufacturers and Types:

Type	McKinney	Hager	Bommer
Type 1	T4A3795	BB1262	BB5024
Type 2	TA2714	BB1279	BB5000
Type 3	TA2314	BB1191	BB5001/BB5002
Type 4	T4A3786	BB1168	BB5004
Type 5	T4A3386	BB1199	BB5005/BB5006

b. Application:

- 1) Exterior outswinging doors Type 5 x NRP
- 2) Exterior inswinging doors and vestibule doors Type 5
- 3) Interior doors with closers Type 2 or 4
- 4) Interior doors over 36 inches wide Type 4
- 5) Interior doors 36 inches or less without closer Type 2
- 6) Provide NRP (non-removable pins) at out-swinging lockable doors.

c. Size:

- 1) 2-1/4 inch Doors 5 inch by 5 inch

- 2) 1-3/4 inch Doors 4-1/2 inch by 4-1/2 inch
- 3) 1-3/8 inch Doors 3-1/2 inch by 3-1/2 inch
- d. Quantity:
 - 1) 2 - hinges per leaf for openings through 60 inches high.
 - 2) 1 - additional hinge per leaf for each additional 30 inches in height or fraction thereof.
- e. Drill 5/32 inch hole and use No. 12, 1-1/4 inch steel threaded to the head wood screws for hinges on wood doors.

B. Electric Hinges

- 1. Provide electric hinges with ElectroLynx™ standardized plug connectors to accommodate up to twelve wires.
- 2. Plug connectors shall plug directly into ElectroLynx™ through-door wiring harnesses for connection to electric locking devices and power supplies.
- 3. Provide sufficient number of concealed wires to accommodate electric function of specified hardware.
- 4. Electric hinges shall be located at second hinge from bottom.
- 5. Locate electric hinges at second hinge from bottom. Where electric hinges are used in conjunction with exit devices, locate hinge nearest to exit device.
- 6. Provide mortar guard similar to McKinney MG-16 for each electric hinge specified.
 - a. Specified Manufacturer: McKinney QC Series
 - b. Approved Substitutes: NONE

C. Continuous Geared Hinges

- 1. All hinges to be non-handed and completely reversible. Hinge line to be available in concealed flush mount with or without inset, full surface and half surface types as specified in the hardware sets. All hinges to be made of extruded 6060 T6 aluminum alloy with polyacetal thrust bearings, anodized after cutouts are made for bearings. All concealed hinges to be fire-rated for 20, 45 and 90 minutes when incorporated into proper door and frame labeled installations, without necessitating the use of fusible-link pins. All concealed hinges to be available in standard, heavy, and extra heavy duty weights; all full surface and half surface hinges in standard and heavy duty weights as specified in the hardware sets. All hinges to be factory cut for door size.
 - a. Specified Manufacturers: McKinney
 - b. Approved Manufacturers: Markar, Pemko

D. Continuous Stainless Steel Hinges

- 1. All hinges to be non-handed and of slim barrel design. Hinges to made of type 304 stainless steel and shall have a concealed teflon-coated stainless steel pin with twin self-lubricated nylon bearings at each knuckle. Hinges shall be UL list up to and including 3 hours and shall be available with power transfer cutouts when necessary.
 - a. Specified Manufacturers: McKinney MCK-FM300
 - b. Approved Manufacturers: Markar

2.4 FLUSH BOLTS AND ACCESSORIES:

- A. All manual and automatic flush bolts to be furnished as specified.
 - 1. Specified Manufacturers: Rockwood
 - 2. Approved Substitutes: McKinney, Burns

2.5 CYLINDERS AND KEYING:

A. CYLINDERS

- 1. Comply with BHMA A156.5 Grade 1.
- 2. Material: Brass or bronze, stainless steel, or nickel silver.
- 3. Finish(es): Match lock mechanism(s) to which cylinders are installed.
- 4. Cylinder Type: Interchangeable cores at all Exit Devices, Removable Mullions, and Locks on All Glass Doors; Conventional cores (non-interchangeable) at all other locksets.
- 5. IC Format: Full-sized Interchangeable Cores (IC).

6. Cylinder Mechanism:
 - a. Conventional, 6-pin tumbler.
 7. Key Control:
 - a. Open.
 8. Determine type required to suit locking mechanisms to which they will be installed. Include appropriate trim rings, cams, tail pieces, and adaptors.
 9. Patented cylinders and keys to protect against from unauthorized manufacture.
 10. Provide cylinders for all locking mechanisms scheduled.
 11. Manufacturers:
 - a. Specified Manufacturer: Corbin Russwin (match existing – Contact Argonne for specific details)
 - b. Approved Substitutes: Sargent, Yale.
- B. KEYING
1. Material: Nickel-silver.
 2. All locks and cylinders shall be construction master-keyed. All locks and cylinders to be master-keyed or grandmaster-keyed as directed by the owner. The factory shall key all locks and cylinders. Furnish the following key amounts:
 - a. Two (2) change keys per lock
 - b. Six (6) grand master keys
 - c. Six (6) master keys per master level
 - d. Fifteen (15) construction/temporary keys
 3. Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging.

2.6 LOCKS & LATCHES

- A. Mortise Locks and Latches:
1. ANSI/BHMA-A156.13, Series 1000, Operational and Security Grade-1, and Security Grade 1 certified.
 2. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum.
 3. The lockset shall have a field-adjustable, beveled armored front, with a .125" minimum thickness and shall be reversible without opening the lock body.
 4. Mortise with antifriction latchbolt with 19 mm 3/4 IN throw and deadbolt with 25mm 1 IN throw.
 5. 70 mm 2-3/4 IN backset.
 6. Base lever handle style: "Newport".
 7. All strikes shall be non-handed.
 8. All locks shall be provided with strike boxes.
 9. To ensure proper alignment, all trim shall be thru-bolted and fully interchangeable between rose and escutcheon designs.
 10. Manufacturer:
 - a. Specified Manufacturer: Corbin Russwin ML2000 Series.
 - b. Approved Substitutes: Sargent 8200 Series, Yale 8800 Series.
 11. Functions as indicated in Hardware Sets and in accordance with ANSI/BHMA-A156.13.
- B. Narrow Stile Deadlocks:
1. All locksets shall be ANSI 156.13 Series 1000 Grade 1 certified. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. Bottom Rail Deadlocks shall have 3/8" diameter bolts.
 - a. Specified Manufacturer: Adams Rite
- C. Electrified Locksets:
1. Supplied by same manufacturer supplying conventional locks and latches

2. Design, level of quality, styles and finishes: Matching requirements listed above for locks and latches.
3. Mechanical features of locksets shall conform to standards as specified above.
4. Locksets shall be designed for both intermittent and continuous duty.
5. Operational Type (mortise):
 - a. RX micro-switches:
 - 1) Built-in switch to signal request-to-exit when occupant uses free lever to depart from the secured room or area.
 - 2) Security system to shunt alarm when signaled by RX switch.
 - 3) Include RX switch in all Electrified Locksets unless otherwise indicated.
6. All locks shall be provided with strike boxes.
7. Manufacturers:
 - a. Specified Manufacturers: Corbin Russwin ML20900 Series
 - b. Approved Manufacturers: Sargent 8200 Series, Yale 8800 Series

2.7 OPERATING TRIM

- A. Pushes and Pulls:
 1. Fabricate push pulls for back to back mounting from 3/4-inch diameter stainless steel bar or tube stock in finish as scheduled. Custom fabricate push pulls to length indicated with minimum 2 3/4-inch projection, minimum 2-inch clearance with bases centered on door stiles and anchored to top and bottom rails. Furnish spacers threaded to accept concealed throughbolt attachment including provision for spanner tightening of bolts of assembly. Do not provide baseplates at stile to pull interface.
 2. Push Plates:
 - a. BHMA J301
 - b. Finish: 630 stainless steel.
 3. Pulls:
 - a. ADA compliant.
 - b. BHMA J405
 - c. Finish: 630 stainless steel.
 4. Manufacturers:
 - a. Specified Manufacturers: Rockwood
 - b. Approved Substitutes: McKinney, Trimco

2.8 EXIT DEVICES

- A. ANSI/BHMA-A156.3, Grade-1; Types and functions as scheduled by the HW-sets and as applicable for door material and other conditions indicated.
- B. Mounting rails shall be formed from a solid single piece of stainless steel, brass, or bronze no less than 0.072" thick.
- C. Push rails shall be constructed of 0.062" thick material.
- D. Painted or anodized aluminum shall not be considered heavy duty and are not acceptable.
- E. Fire Rated Openings:
 1. Use Fire-rated devices.
 2. Bearing Underwriters Laboratories label for life safety in full compliance with NFPA 80 and NFPA 101.
- F. Non-rated openings:
 1. Typical: Use doggable (UL-listed for accident hazard) devices.
 - a. Hex key dogging shall be standard for all life safety panic hardware.
 - b. Exception 1: Omit dogging where (non-fire rated) openings occur in a Smoke Partitions (Fire rated devices are also acceptable).
 - c. Exception 2: Omit dogging where openings that include Cardreaders and any where that dogging could compromise ability to secure the opening (Fire rated devices are also acceptable).

- G. Where CVR (concealed vertical rod) devices are scheduled:
 1. Include bottom rods at all exterior openings.
 2. At all interior openings: Provide LBR (Less Bottom Rod) where permitted by label. Include thermal (fire) pins and other required items to compensate.
- H. Where LBR (less bottom rod) devices are scheduled:
 1. Doors in pairs shall operate independently without use of coordinators or open back strikes.
- I. Include cylinders at lockable devices.
- J. Lever Style: Match lever style specified for Locks and Latches.
- K. Manufacturers:
 1. Specified Manufacturer: Corbin Russwin ED4000/ED5000 Series
 2. Approved Substitutes: Sargent NB-80 Series, Von Duprin 35A/98 Series, Yale 7100/7200 Series

2.9 ELECTRIC STRIKES

- A. All electric strikes shall meet BHMA standard 501, grade 1 and be UL Listed for Burglary Resistance, category 1034. Strikes shall be all stainless steel construction for corrosion resistance, strength and durability. Strikes shall have been tested to withstand a forcing strength of a minimum 2400 lbs. before releasing and perform with a minimum of one million cycles of operation. Strikes shall be 24VDC fail safe or fail secure as specified
- B. Manufacturers:
 1. Specified Manufacturers: Folger Adam 310 2 3/4
 2. Approved Manufacturers: HES 1006

2.10 ELECTRIFIED DEVICES

- A. Electrified exit devices shall conform to all traditional exit device standards as specified above. All power requirements for exit devices used must utilize a continuous circuit electric hinge for clean design and no visible means of interrupting power to device.
- B. Manufacturers:
 1. Specified Manufacturers: Corbin Russwin ED4000/ED5000 Series
 2. Approved Manufacturers: Sargent 80 Series, Von Duprin 35A/98 Series, Yale 7100/7200 Series

2.11 SURFACE-APPLIED DOOR CLOSERS – HEAVY DUTY

- A. Door Closers (surface-applied):
 1. Comply with BHMA A156.4, Grade 1.
 2. All closers to have non-ferrous covers, aluminum alloy bodies, forged steel arms, and separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to provide up to 50% increase in spring power.
 3. Closers shall be constructed with a one-piece body.
 4. Closers shall be furnished with parallel arms mounting on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit.
 5. UL-listed for use on fire doors.
 6. Size door closers to comply with manufacturer's recommendations for door sizes, locations, and accessibility requirements for opening force.
 7. Closers adjustable to 3 second closing speed from 70 DEG opening to 3 IN from latch.
 8. Supply arms, brackets, and plates, as required.
 9. Mount on closers on "room side" of corridor doors, unless conditions expressly prohibit such mounting.
 - a. Where proposing to locate closers on "Corridor side": Notify Architect, in writing, and obtain approval prior to installing.
 10. Closers with integral back checks.

11. Furnish with non-hold open arms unless otherwise indicated
12. Entrance and vestibule doors: Delayed action closer and overhead stop.
13. Other exterior out-swinging doors: Closer with limiting cushion stop.
14. Manufacturers:
 - a. Preferred Manufacturer: LCN 4040 Series
 - b. Approved Substitutes: Norton 7500 Series, Sargent 351 Series, Yale 4400 Series

2.12 DOOR TRIM AND PROTECTIVE PLATES

- A. Kick plates shall be .050 gauges and two (2) inches less full width of door, or as specified. Push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware schedule.
- B. Manufacturers:
 1. Specified Manufacturers: Rockwood
 2. Approved Substitutes: McKinney, Trimco

2.13 DOOR STOPS AND HOLDERS

- A. Wall Mounted Door Stops
 1. Where a door is indicated on the plans to strike flush against a wall, wall bumpers shall be provided. Provide convex or concave design as indicated.
 2. Manufacturers:
 - a. Specified Manufacturers: Rockwood
 - b. Approved Substitutes: McKinney, Trimco
- B. Overhead Stops/holders
 1. Where specified, overhead stops as shown in the hardware sets are to be provided. Track, slide, arm and jamb bracket shall be constructed of extruded bronze and shock absorber spring shall be of heavy tempered steel. Overhead stops shall be of non-handed design.
 2. Manufacturers:
 - a. Specified Manufacturers: Rixson
 - b. Approved Substitutes: Sargent, ABH
- C. Magnetic Hold-Opens
 1. Magnetic door holders shall meet or exceed ANSI A156.15 and be UL listed 228 for Door Closer and Holders, with or without integral smoke detectors. Holding force shall be 40 pounds at 24VDC and shall be fail-safe. Pushpin release that eliminates residual magnetism shall be standard.
 2. Manufacturers:
 - a. Specified Manufacturers: Rixson
 - b. Approved Substitutes: HES, Sargent

2.14 GASKETING AND THRESHOLDS

- A. Provide continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide intumescent seals as required to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- B. Provide threshold units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the Americans with Disabilities Act (ADA.)
- C. Manufacturers:
 1. Specified Manufacturers: Pemko
 2. Approved Substitutes: McKinney, Zero

2.15 SILENCERS

- A. Furnish rubber door silencers equal to Rockwood 608 for all new interior hollow metal frames, two (2) per pair and three (3) per single door frame up to 7'6" and one additional for every 30" in door height.

2.16 ELECTRONIC ACCESSORIES

- A. Proximity Readers
 - 1. Refer to Section 28 13 13.
- B. Power Supplies
 - 1. Power supplies shall furnish regulated 24VDC and shall be UL class 2 listed. LED's shall monitor zone status (voltage/no voltage) and slide switches shall be provided to connect or disconnect the load from power; 1, 4 or 8 separate output circuit breakers shall be provided to divide the load. Power supplies shall have the internal capability of charging optional 24VDC sealed lead acid batteries in addition to operating the DC load. Power supplies shall be supplied complete requiring only 120VAC to the fused input and shall be supplied in an enclosure. Power supplies shall be provided with emergency release terminals that allow the release of all devices upon activation of the fire alarm system.
 - 2. Manufacturers:
 - a. Specified Manufacturer: Securitron BPS
 - b. Approved Substitutes: Sargent

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes responsibility for performance.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions, supervised or inspected by an AHC.
- B. Fit hardware before final door finishing.
- C. Permanently install hardware after finishing operations are complete.
- D. Mounting Heights:

Mounting Heights of Hardware	
Item	Height ^{1,2} (to Item Centerline)
Mortise Locksets	40-5/16 IN AFF to Centerline of Strike ³
Cylindrical Locksets	
Patient Latches	
Exit Devices	
Door Pulls	42 IN AFF to Centerline of Pull
Pushplates	45 IN AFF to Centerline of Plate
Auxiliary Deadbolts	48 IN AFF to Centerline of Strike
Butt Hinges (and Pivots)	Top Hinge: Not more than 11-3/4 IN down from frame
	Bottom Hinge: Not more than 13 IN above floor

	Equally spaced between Top and Bottom Hinges. Refer to Part 2 for quantity required.
Other Items	Comply with SDI and DHI Recommendations

Footnotes/Additional Requirements:

1. *Mounting Heights shall also comply with ADA and ICC/ANSI 117.1*
2. *Mounting Heights shall also comply with prevailing Building Code and Fire Codes.*
3. *Deviation of from listed height will be allowed up to \pm 1-1/2 IN provided this does not cause a conflict of between the lock and lite cutouts.*

- E. Install hardware with fasteners concealed where not required by code to be exposed.
- F. Coordinate installation of electric access control hardware.
 1. Hardware installer to be responsible for coordination with electrical installer for low voltage installations.
- G. Door Position Switches (DPS):
 1. Coordinate door and frame preparations with door and frame suppliers and Security System installer as appropriate.
 2. Locate in frame head approximately 100mm 4IN from latching door edge, unless otherwise instructed.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware to ensure proper operation or function.
 1. Lubricate moving parts with lubricant recommended by manufacturer.
 2. Replace units which cannot be adjusted and lubricated to operate smoothly.
- B. Conversion of Construction Keying to Permanent (by Contractor):
 1. Convert cylinders from “construction” to “permanent” configuration at time of Substantial Completion.
 2. Demonstrate conversion method to Laboratory’s facility personnel, making certain Laboratory’s team understands methodology.
- C. Approximately six months after substantial completion, check and readjust to assure proper function of doors and hardware.
 1. Clean and lubricate operational items.
 2. Replace items which have deteriorated or failed.
 3. Prepare a written report of current and predictable problems in operation of hardware.
 4. Report visit and furnish copy of report to Laboratory with copy to Architect.
- D. When hardware is installed more than one month prior to final acceptance or occupancy, during week prior to acceptance or occupancy, make a final check and adjustment of hardware items.
 1. Clean and lubricate as necessary to assure proper function and finish.
 2. Adjust door control devices to compensate for operation of heating and ventilating equipment.
- E. Instruct Laboratory's personnel:
 1. Operating and maintenance procedures.
 2. Key control system.
 3. Methodology used to re-key cylinders from “construction” to “permanent” configuration.
- F. Prior to substantial completion instruct Laboratory's personnel in systems operation.
 1. Standard system operation and maintenance.
 2. Modification of codes.
 3. Acquisition, monitoring and scheduling of ID cards.
 4. Instruction in software applications.

3.4 HARDWARE SCHEDULE

A. The following schedule is furnished for whatever assistance it may afford the Contractor; do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware group, provide door or item with hardware same as required for similar purposes. Quantities listed are for each pair of doors, or for each single door.

B. Manufacturer's Abbreviations:

1. AR – Adams Rite
2. CR – Corbin Russwin
3. MC – McKinney
4. NO – Norton
5. PE – Pemko
6. RO – Rockwood
7. RX – Rixson
8. SN – Securitron

Set #01.1

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Passage Latchset	ML2010 LSA	630	CR
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #01.2

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Passage Latchset	ML2010 LSA	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #01.3

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Passage Latchset	ML2010 LSA	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Overhead Stop	9 Series	630	RX
3 Silencers	608	Grey	RO

Set #01.4

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Passage Latchset	ML2010 LSA	630	CR
1 Closer/Stop	CPS-7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
3 Silencers	608	Grey	RO

Set #01.5

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 Manual Flush Bolts	555	626	RO
1 Dust Proof Strike	570	626	RO
1 Passage Latchset	ML2010 LSA	630	CR
1 Closer/Stop	CPS-7500	689	NO
NOTE: Mount closer/stop at active leaf.			
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Overhead Stop	9 Series	630	RX
NOTE: Mount overhead stop at inactive leaf.			
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #01.6

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 Manual Flush Bolts	555	626	RO
1 Dust Proof Strike	570	626	RO
1 Passage Latchset	ML2010 LSA	630	CR
1 Closer/Stop	CPS-7500	689	NO
NOTE: Mount closer/stop at active leaf.			
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
NOTE: Mount wall stop at inactive leaf.			
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #02.1

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Entrance Lockset	ML2051 LSA	630	CR
1 Wall Stop	400	626	RO
1 Coat Hook	806	626	RO
3 Silencers	608	Grey	RO

Set #03.1

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #03.2

3 Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Closer	PR7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #03.3

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S773 D		PE

Set #03.4

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Overhead Stop	9 Series	630	RX
1 Gasket	S773 D		PE

Set #03.5

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Overhead Stop	9 Series	630	RX
1 Gasket	S773 D		PE

Set #03.6

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Closer/Stop	CPS-7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Gasket	S773 D		PE

Set #03.7

6 Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
2 Manual Flush Bolts	555	626	RO
1 Dust Proof Strike	570	626	RO
1 Classroom Lockset	ML2055 LSA	630	CR
2 Closer/H-O/Spring Stop	CPS-7500-T	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #03.8

6 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
1 Set Self-Latching Flush Bolts	1945	626	RO
1 Dust Proof Strike	570	626	RO
1 Classroom Lockset	ML2055 LSA	630	CR
1 Coordinator	1600 Series	PC	RO
2 Mounting Bracket	1601AB / 1601C	PC	RO
1 Closer/Stop	CPS-7500	689	NO
NOTE: Mount closer/stop at active leaf.			
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
NOTE: Mount wall stop at inactive leaf.			
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #03.9

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #03.10

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Classroom Lockset	ML2055 LSA	630	CR
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #04.1

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Storeroom Lockset	ML2057 LSA	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S88 D		PE

Set #04.2

3 Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
1 Storeroom Lockset	ML2057 LSA	630	CR
1 Closer	PR7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #04.3

3 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
1 Storeroom Lockset	ML2057 LSA	630	CR
1 Closer	PR7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #04.4

3 Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
1 Storeroom Lockset	ML2057 LSA x M21	630	CR
1 Closer	PR7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Floor Stop	441CU	626	RO
3 Silencers	608	Grey	RO

Set #04.5

3 Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
1 Storeroom Lockset	ML2057 LSA x M21	630	CR
1 Closer	PR7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #04.6

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Storeroom Lockset	ML2057 LSA x M21	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #04.7

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Storeroom Lockset	ML2057 LSA x M21	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S88 D		PE

Set #04.8

8 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Semi Auto Flush Bolt Set	1945	626	RO
1 Dust Proof Strike	570	626	RO
1 Storeroom Lockset	ML2057 LSA x M21	630	CR
2 Closer	CPS 7500	689	NO
2 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #05.1

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Push Plate	70F - 8" x 16"	630BIO	RO
1 Pull Plate	111 x 70C - 4" x 16"	630BIO	RO
1 Closer	7500	689	NO
1 Mop Plate	K1050 - 4" x 1" LDW 4BE CSK	630	RO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
3 Silencers	608	Grey	RO

Set #06.1

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Rim Exit Device	ED5200A x L910 x M110	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S88 D		PE

Set #06.2

3 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 Rim Exit Device	ED5200A x L910 x M110	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Floor Stop	441CU	626	RO
1 Gasket	S88 D		PE

Set #06.3

3 Hinges	TA2714 4-1/2 x 4-1/2	652	MC
1 Rim Exit Device	ED5200A x L910 x M110	630	CR
1 Closer	7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S88 D		PE

Set #07.1

3 Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
1 Rim Exit Device	ED5200A x L959 x M21 x M110	630	CR
1 Rim Cylinder	3080	626	CR
1 Closer	PR7500	689	NO
1 Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S88 D		PE

Set #08.1

6 Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
1 CVR Exit Device	ED5860B x M55 x M110	630	CR
1 CVR Exit Device	ED5860B x L959 x M21 x M55 x M110	630	CR
1 Rim Cylinder	3080	626	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Wall Stop	400	626	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #09.1

8 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
1 SVR Exit Device	ED5470 x M55 x M110	630	CR
1 SVR Exit Device	ED5470 x L959 x M55 x M110	630	CR
1 Rim Cylinder	3080	626	CR
2 Closer/Stop	CPS-7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #09.2

8 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
1 SVR Exit Device	ED5470B x M55 x M110	630	CR
1 SVR Exit Device	ED5470B x L959 x M55 x M110	630	CR
1 Rim Cylinder	3080	626	CR
2 Closer/Stop	CPS-7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #10.1

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1 SVR Exit Device	ED5470B x M55 x M110	630	CR
1 SVR Exit Device	ED5470B x L910 x M55 x M110	630	CR
2 Closer	7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Overhead Stop	9 Series	630	RX
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #11.1

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 SVR Exit Device	ED5470B x M55 x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Floor Stop	441CU	626	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #11.2

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 SVR Exit Device	ED5470B x M55 x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Wall Stop	400	626	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #11.3

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 SVR Exit Device	ED5470B x M55 x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Wall Stop/Holder	490	626	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #11.4

8 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 SVR Exit Device	ED5470B x M55 x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Wall Stop/Holder	490	626	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Set #12.1

8 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 CVR Exit Device	ED5800A x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Door Stop	471	626	RO
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

NOTE: Overlapping astragal by door manufacturer.

Set #13.1

NOTE: All hardware furnished by overhead door manufacturer.

Set #13.2

Cylinder(s)	as required	626	CR
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NOTE: Balance of hardware furnished by glass door manufacturer.

Set #E1.1

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 SVR Exit Device	ED5470 x M55 x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Electro-Magnetic Door Holder	998	626	RX
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE

Operation Description: Doors are normally closed, latched and secure. Free egress is allowed at all times. Doors can be held open on electro-magnetic door holders. In case of loss of power or fire alarm, the holders are released and both doors close and latch. Key in outside cylinder locks or unlocks outside lever for entry.

Set #E1.2

6 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 SVR Exit Device	ED5470B x M55 x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Electro-Magnetic Door Holder	998	626	RX
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Operation Description: Doors are normally closed, latched and secure. Free egress is allowed at all times. Doors can be held open on electro-magnetic door holders. In case of loss of power or fire alarm, the holders are released and both doors close and latch. Key in outside cylinder locks or unlocks outside lever for entry.

Set #E1.3

8 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 SVR Exit Device	ED5470 x M55 x M110	630	CR
2 Closer	PR7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Electro-Magnetic Door Holder	998	626	RX
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE

Operation Description: Doors are normally closed, latched and secure. Free egress is allowed at all times. Doors can be held open on electro-magnetic door holders. In case of loss of power or fire alarm, the holders are released and both doors close and latch. Key in outside cylinder locks or unlocks outside lever for entry.

Set #E1.4

8	Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2	SVR Exit Device	ED5470B x M55 x M110	630	CR
2	Closer	PR7500	689	NO
2	Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2	Electro-Magnetic Door Holder	998	626	RX
1	Gasket	S88 D		PE
1	Meeting Stile Gasket	S772 D		PE

Operation Description: Doors are normally closed, latched and secure. Free egress is allowed at all times. Doors can be held open on electro-magnetic door holders. In case of loss of power or fire alarm, the holders are released and both doors close and latch. Key in outside cylinder locks or unlocks outside lever for entry.

Set #E2.1

2	Continuous Hinge	MCK-25HD	CL	MC
2	Pull/Push Bar Set	BF15847	630	RO
2	Top Jamb Closer	J7500	689	NO
2	Overhead Stop	6 Series	630	RX
1	Threshold	171 A		PE
2	Sweep	18061 CNB		PE
1	Set Weatherstrip	by Aluminum Door Manufacturer		
1	Astragal	by Aluminum Door Manufacturer		
2	Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E3.1

2	Continuous Hinge	MCK-25HD	CL	MC
1	Removable Mullion	808	628	CR
2	Rim Exit Device	ED4200 x M110	630	CR
2	Top Jamb Closer	J7500	689	NO
2	Overhead Stop	6 Series	630	RX
1	Threshold	171 A		PE
2	Sweep	18061 CNB		PE
1	Set Weatherstrip	by Aluminum Door Manufacturer		
1	Astragal	by Aluminum Door Manufacturer		
2	Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E3.2

8 Hinges	T4A3386 4-1/2 x 4-1/2 x NRP	630	MC
1 Removable Mullion	910KM	628	CR
2 Rim Exit Device	ED5200 x M110	630	CR
1 Mortise Cylinder	1080 (for mullion)	626	CR
2 Closer	PR7500	689	NO
2 Overhead Stop	1 Series	630	RX
1 Threshold	171 A		PE
1 Set Weatherstrip	2891 APK		PE
2 Astragal	18041 CNB		PE
2 Sweep	18061 CNB		PE
1 Rain Drip	346 C		PE
2 Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E3.3

8 Hinges	T4A3386 4-1/2 x 4-1/2 x NRP	630	MC
1 Removable Mullion	910KM	628	CR
1 Rim Exit Device	ED5200 x M110	630	CR
1 Rim Exit Device	ED5200 x K157 x M110	630	CR
1 Mortise Cylinder	1080 (for mullion)	626	CR
1 Rim Cylinder	3080	626	CR
1 Offset Pull	BF158 - 1" x 12" ctc	630	RO
2 Closer	PR7500	689	NO
2 Overhead Stop	1 Series	630	RX
1 Threshold	171 A		PE
1 Set Weatherstrip	2891 APK		PE
2 Astragal	18041 CNB		PE
2 Sweep	18061 CNB		PE
1 Rain Drip	346 C		PE
2 Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E4.1

1 Continuous Hinge	MCK-25HD	CL	MC
1 Deadlatch	4900 Series	628	AR
1 Deadlatch Paddle	4591	628	AR
1 Cylinder Guard	MS4043	130	AR
1 Mortise Cylinder	1080	626	CR
1 Pull/Push Bar Set	BF15847	630	RO
1 Cam Action Closer	PS2800ST x Mounting Plate	689	NO
1 Overhead Stop	6 Series	630	RX
1 Threshold	171 A		PE
1 Sweep	18061 CNB		PE
1 Set Weatherstrip	by Aluminum Door Manufacturer		
1 Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E5.1

3	Hinges	T4A3386 4-1/2 x 4-1/2 x NRP	630	MC
1	Storeroom Lockset	ML2057 LSA	630	CR
1	Closer	PR7500	689	NO
1	Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1	Overhead Stop	1 Series	630	RX
1	Threshold	171 A		PE
1	Set Weatherstrip	2891 APK		PE
1	Sweep	18061 CNB		PE
1	Rain Drip	346 C		PE
1	Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E5.2

8	Hinges	T4A3386 4-1/2 x 4-1/2 x NRP	630	MC
1	Set Self-Latching Flush Bolts	1845	626	RO
1	Dust Proof Strike	570	626	RO
1	Storeroom Lockset	ML2057 LSA	630	CR
2	Closer	PR7500	689	NO
2	Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2	Overhead Stop	1 Series	630	RX
1	Threshold	171 A		PE
1	Set Weatherstrip	2891 APK		PE
1	Astragal	375 CR		PE
2	Sweep	18061 CNB		PE
1	Rain Drip	346 C		PE
2	Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E5.3

6	Hinges	T4A3386 4-1/2 x 4-1/2 x NRP	630	MC
1	Set Self-Latching Flush Bolts	1845	626	RO
1	Dust Proof Strike	570	626	RO
1	Storeroom Lockset	ML2057 LSA	630	CR
2	Closer	PR7500	689	NO
2	Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2	Overhead Stop	1 Series	630	RX
1	Threshold	171 A		PE
1	Set Weatherstrip	2891 APK		PE
1	Astragal	375 CR		PE
2	Sweep	18061 CNB		PE
1	Rain Drip	346 C		PE
2	Door Position Switch	Refer to Section 28 13 13.		

NOTE: Door position switches – refer to Section 28 13 13.

Set #E6.1

8 Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
2 Power transfer	CEPT	626	SN
2 CVR Exit Device	ED5800A x M94 x M110	630	CR
2 Automatic Operator	6960-D	689	NO
2 Actuator Switch	685		NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Overhead Stop	9 Series	630	RX
1 Gasket	S88 D		PE
1 Meeting Stile Gasket	S772 D		PE
NOTE: Overlapping astragal by door manufacturer.			
1 Power Controller	781N		CR
1 Wiring Diagram	Provided by Hardware Supplier		

Note: Hard wire all actuators for power operators, no RFI switches will be allowed.

Operation Description: Doors are normally closed and latched. Depressing the touchpad on either exit device retracts the latches for free egress at all times. Pressing either automatic operator actuator switch signals the electric latch retraction and powers both doors open. In case of power failure or fire alarm, the electric latches are extended (fail secure) and the automatic operators are deactivated.

Set #E7.1

6 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
1 Power transfer	CEPT	626	SN
1 CVR Exit Device	ED5860 x M55 x M110	630	CR
1 CVR Exit Device	ED5860 x L959 x M55 x M94 x M110	630	CR
1 Rim Cylinder	3080	626	CR
1 Closer	PR7500	689	NO
1 Automatic Operator	6960	689	NO
2 Actuator Switch	685		NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
2 Wall Stop	400	626	RO
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE
1 Power Controller	781N		CR
1 Key Switch	MKA		SN
1 Mortise Cylinder	1080 (for key switch)	626	CR
1 Wiring Diagram	Provided by Hardware Supplier		

Note: Hard wire all actuators for power operators, no RFI switches will be allowed.

Operation Description: Doors are normally closed and latched. Depressing the touchpad on either exit device retracts the latches for free egress at all times. Pressing the automatic operator actuator switch on the push side of the door signals the electric latch retraction and powers the active door open. The key switch is used to keep the electric latch retracted and activate the actuator switch on the pull side of the door. When active, the door can be powered open by either actuator switch. In case of power failure or fire alarm, the electric latch is extended (fail secure) and the automatic operator is deactivated. Cylinder outside unlocks outside lever for entrance. Key is only removable in locked position.

Set #ES1.1

8 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
2 Power transfer	CEPT	626	SN
1 SVR Exit Device	ED5470 x M55 x M92 x M110	630	CR
1 Access Control SVR Exit Device	ED5470N x L9S605 x M55 x M110	630	CR
1 Card Reader	Refer to Section 28 13 13.		
1 Rim Cylinder	3080	626	CR
2 Closer/Stop	CPS-7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE
1 Power Supply	BPS-12-2		SN
2 Door Position Switch	Refer to Section 28 13 13.		
1 Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The doors shall be normally closed and locked. Electrified exit device shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified exit device unlocking the outside lever handle permitting entry. Depressing the touchpad from the inside will allow egress at all times.

Set #ES1.2

8 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
2 Power transfer	CEPT	626	SN
1 SVR Exit Device	ED5470B x M55 x M92 x M110	630	CR
1 Access Control SVR Exit Device	ED5470BN x L9S605 x M55 x M110	630	CR
1 Card Reader	Refer to Section 28 13 13.		
1 Rim Cylinder	3080	626	CR
2 Closer/Stop	CPS-7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE
2 Door Position Switch	Refer to Section 28 13 13.		
1 Power Supply	BPS-12-2		SN
1 Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The doors shall be normally closed and locked. Electrified exit device shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified exit device unlocking the outside lever handle permitting entry. Depressing the touchpad from the inside will allow egress at all times.

Set #ES2.1

3	Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1	Lockset	ML2055 LSA	630	CR
1	Electric Strike	310-2 3/4	630	FA
1	Card Reader	Refer to Section 28 13 13.		
1	Closer	7500	689	NO
1	Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1	Wall Stop	400	626	RO
1	Gasket	S773 D		PE
1	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-2		SN
1	Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES2.2

3	Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1	Lockset	ML2055 LSA	630	CR
1	Electric Strike	310-2 3/4	630	FA
1	Card Reader	Refer to Section 28 13 13.		
1	Closer	7500	689	NO
1	Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1	Overhead Stop	9 Series	630	RX
1	Gasket	S773 D		PE
1	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-2		SN
1	Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES2.3

3	Hinges	T4A3786 4-1/2 x 4-1/2	652	MC
1	Lockset	ML2055 LSA	630	CR
1	Electric Strike	310-2 3/4	630	FA
1	Card Reader	Refer to Section 28 13 13.		
1	Closer/Stop	CPS-7500	689	NO
1	Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1	Gasket	S773 D		PE
1	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-2		SN
1	Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES2.4

6	Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
2	Manual Flush Bolts	555	626	RO
1	Dust Proof Strike	570	626	RO
1	Lockset	ML2055 LSA	630	CR
1	Electric Strike	310-2 3/4	630	FA
1	Card Reader	Refer to Section 28 13 13.		
1	Closer/Stop	CPS-7500	689	NO
2	Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1	Overhead Stop	9 Series	630	RX
1	Gasket	S773 D		PE
1	Meeting Stile Gasket	S772 D		PE
2	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-2		SN
1	Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES2.5

6 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
2 Manual Flush Bolts	555	626	RO
1 Dust Proof Strike	570	626	RO
1 Lockset	ML2055 LSA	630	CR
1 Electric Strike	310-2 ¾	630	FA
1 Card Reader	Refer to Section 28 13 13.		
1 Closer/Stop	CPS-7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE
2 Door Position Switch	Refer to Section 28 13 13.		
1 Power Supply	BPS-12-2		SN
1 Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES2.6

6 Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
1 Set Self-Latching Flush Bolts	1945	626	RO
1 Dust Proof Strike	570	626	RO
1 Lockset	ML2055 LSA	630	CR
1 Electric Strike	310-2 ¾	630	FA
1 Card Reader	Refer to Section 28 13 13.		
1 Closer/Stop	CPS-7500	689	NO
2 Kickplate	K1050 - 12" x 1" LDW 4BE CSK	630	RO
1 Wall Stop	400	626	RO
1 Gasket	S773 D		PE
1 Meeting Stile Gasket	S772 D		PE
2 Door Position Switch	Refer to Section 28 13 13.		
1 Power Supply	BPS-12-2		SN
1 Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES2.7

3	Hinges	TA2714 4-1/2 x 4-1/2 x NRP	652	MC
1	Lockset	ML2055 LSA	630	CR
1	Electric Strike	310-2 3/4	630	FA
1	Card Reader	Refer to Section 28 13 13.		
1	Closer	PR7500	689	NO
1	Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1	Wall Stop	400	626	RO
3	Silencers	608	Grey	RO
1	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-2		SN
1	Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES2.8

3	Hinges	T4A3786 4-1/2 x 4-1/2 x NRP	652	MC
1	Lockset	ML2055 LSA	630	CR
1	Electric Strike	310-2 3/4	630	FA
1	Card Reader	Refer to Section 28 13 13.		
1	Closer	PR7500	689	NO
1	Kickplate	K1050 - 12" x 2" LDW 4BE CSK	630	RO
1	Wall Stop	400	626	RO
3	Silencers	608	Grey	RO
1	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-2		SN
1	Wiring Diagram	Provided by Hardware Supplier		

Operations Narrative: The door shall be normally closed and locked. Electrified strike shall be fail secure and remain locked without power. Authorized entry by means of card reader will send power to the electrified strike permitting entry. Rotating the lever handle from the inside will allow egress at all times.

Set #ES3.1

2	Continuous Hinge	MCK-25HD x <u>EPT</u>	CL	MC
2	Power transfer	CEPT	626	SN
1	Removable Mullion	808	628	CR
1	Rim Exit Device	ED4200 x M51 x M92 x M110	630	CR
1	Rim Exit Device	ED4200 x K157 x M92 x M94 x M110	630	CR
1	Rim Cylinder	3080	626	CR
1	Offset Pull	BF158 - 1" x 12" etc	630	RO
2	Top Jamb Closer	J7500	689	NO
2	Overhead Stop	6 Series	630	RX
1	Threshold	171 A		PE
2	Sweep	18061 CNB		PE
1	Set Weatherstrip	by Aluminum Door Manufacturer		
1	Astragal	by Aluminum Door Manufacturer		
1	Power Controller	781N		CR
2	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-1		SN
1	Card Reader	Refer to Section 28 13 13.		
1	Wiring Diagram	Provided by Hardware Supplier		

Operation Description: Door is normally closed, latched and secure.

Outside Operation: Presenting a valid credential in the card reader sends power to electrically retract the latch of the active door so the door can be pulled open.

Inside Operation: Pressing the exit device touchpad shunts the door position switch with the request to exit (M92) switch. Door egress allowed at all times DPS just deactivates alarm or warning in access control system.

Power Failure: In case of loss of power, latch is extended and door is locked (fail secure). Key outside retracts latch for entry; key is only removable in locked position.

Set #ES4.1

8	Hinges	T4A3386 4-1/2 x 4-1/2 x NRP	630	MC
2	Power transfer	CEPT	626	SN
1	Mortar Guard	MG-16	2C	MC
1	Removable Mullion	910KM	628	CR
1	Rim Exit Device	ED5200 x M51 x M92 x M110	630	CR
1	Rim Exit Device	ED5200 x K157 x M92 x M94 x M110	630	CR
1	Mortise Cylinder	1080	626	CR
1	Rim Cylinder	3080	626	CR
1	Offset Pull	BF158 - 1" x 12" ctc	630	RO
2	Closer	PR7500	689	NO
2	Overhead Stop	1 Series	630	RX
1	Threshold	171 A		PE
1	Set Weatherstrip	2891 APK		PE
2	Astragal	18041 CNB		PE
2	Sweep	18061 CNB		PE
1	Rain Drip	346 C		PE
1	Power Controller	781N		CR
2	Door Position Switch	Refer to Section 28 13 13.		
1	Power Supply	BPS-12-1		SN
1	Card Reader	Refer to Section 28 13 13.		
1	Wiring Diagram	Provided by Hardware Supplier		

Operation Description: Door is normally closed, latched and secure.

Outside Operation: Presenting a valid credential in the card reader sends power to electrically retract the latch of the active door so the door can be pulled open.

Inside Operation: Pressing the exit device touchpad shunts the door position switch with the request to exit (M92) switch. Door egress allowed at all times DPS just deactivates alarm or warning in access control system.

Power Failure: In case of loss of power, latch is extended and door is locked (fail secure). Key outside retracts latch for entry; key is only removable in locked position.

END OF SECTION

SECTION 08 71 13
AUTOMATIC DOOR EQUIPMENT - SWINGING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Automatic Door Equipment – Swinging Doors, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. General:
 - 1. Comply with ANSI 117.1 and NFPA 101 Life Safety Code.
- B. LPO and LPO/FDO Operators and assemblies:
 - 1. Comply with “Standards for Power Assist and Low Energy Power Operated Doors” by ANSI/BHMA-A156.19.
- C. Accessibility:
 - 1. All openings shall comply with ADA.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- E. Exit Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Interface drawings for operators to be installed in storefront/curtain wall.
 - 2. Point to point wiring diagrams showing connections to electrified hardware devices and access control system devices.
- B. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation and safety devices. Include operating characteristics, electrical characteristics, and furnished accessories.
- C. Project Information:
 - 1. UL listing data.
- D. Contract Closeout Information:
 - 1. Operating and maintenance data.
 - 2. Owner instruction report.
- E. Field Measurements: Verify actual dimensions of door frames by field measurements before fabrication of exposed covers for automatic door operators.
- F. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 COORDINATION

- A. Coordinate size and locations of recesses in concrete floors for recessed control mats that control automatic door operators.
 1. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- B. Templates:
 1. Obtain and distribute, to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators.
 2. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.
- C. Electrical System Roughing-in:
 1. Coordinate layout and installation of automatic door operators, including activation and safety devices, with connections to power supplies and to access-control system.
 2. Coordinate installation and connection with work required under Electrical Specifications Division.
- D. Coordinate fitting and installation of automatic door operators with manufacture, preparation and installation of wood and aluminum doors to be operated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Automatic Door Operators (swinging type):
 1. Base:
 - a. Besam.
 2. Optional:
 - a. Horton Automatics.
 - b. Stanley Access Technologies.
 - c. Gyro Tech.
 - d. LCN.
 - e. Record.
- B. Actuation and Safety Devices:
 1. Base:
 - a. BEA.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Aluminum:
 1. Sheet: ASTM-B206.
 2. Extrusions: ASTM-B221.
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

2.3 AUTOMATIC DOOR OPERATORS

- A. General:
 - 1. Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated; and complying with UL 325.
 - 2. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
- B. Maximum Opening Force if Power Fails:
 - 1. Not more than 30 LBS of force to manually set door in motion.
 - 2. Not more than 15 LBS of force to fully open door.
- C. Power-operated Fire Doors and Smoke Doors:
 - 1. Provide approved operators, and components in compliance NFPA 80, as certified by a nationally recognized testing laboratory.
 - a. Include relays, contacts, circuit boards.
 - b. UL listed and tested as fire door assembly.
 - 2. Connect Fire Alarm System to all Operators of openings that are installed in fire-rated walls and smoke-rated walls.
 - a. When Fire Alarm is activated: Interrupt power to these operators. Users may only open doors manually under fire alarm conditions.
 - b. In manual mode: Forces required to operate doors shall continue to comply with maximum operation forces allowed by ADA and other locally adopted accessibility regulations.
- D. Fire-Door Package:
 - 1. Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors.
 - 2. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes.
 - 3. Provide latch actuators with fail-secure design.
- E. Units Scheduled on Exterior Openings:
 - 1. Wind Load Resistance:
 - a. Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to prevailing wind forces.
 - b. Adjust in field to suit localized variation in wind pressure.
- F. Operating Temperature:
 - 1. Designed to operating within temperature ranges of --20 to 160 DegF.
- G. Electromechanical Operating System:
 - 1. Self-contained unit powered by 24 volt, 1/8 hp motor. Spring shall be adjustable to compensate for different manual push forces required on varying door widths.
 - 2. Connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
 - 3. Electronic control allows for increases of forces to overcome minor stack pressures. The control automatically compensates for lower manual push forces when the door is used in manual mode in order to comply with ANSI A156.19.
 - 4. Electronic dampening which automatically counteracts additional forces applied to the door during the opening of closing cycle by reducing door speed.
- H. Operator Covers:
 - 1. Fabricated thick extruded or formed aluminum extending continuously over full width of door opening including door jambs.
 - a. Minimum sheet thickness: 0.156 IN.
 - 2. Include end caps, provision for maintenance access, and concealed fasteners

- I. Brackets and Reinforcements:
 - 1. Manufacturer's standard, fabricated from aluminum with non-staining, non-ferrous shims for aligning system components.

2.4 STANDARD POWER OPERATORS

- A. General:
 - 1. Operator complying with ANSI/BHMA 156.10.
 - 2. Electro-mechanical operator, powered by Minimum 1/4 HP, continuous duty.
 - a. Voltage: 110-120 VAC; <10 Amp.
 - 3. Factory-assembled, and sealed unit including helical gear drive transmission and interconnected rack and gear system for compression heavy duty spiral spring.
 - a. Housing enclosure: Die cast aluminum housing.
 - b. Spring: Replaceable.
 - c. Mount operator using vibration isolators.
 - 4. Operation:
 - a. Power-open/Spring-close.
 - b. Operate as door closer in event of power failure.
 - c. Include safe swing circuit that slows door if sensing device is activated while door is in operating cycle.
 - d. Both OPEN and CLOSE speeds adjustable.
 - 5. Electronic Controls:
 - a. Self-contained, Microprocessor based system controlling operation and switching of the operator.
 - b. Integral low voltage power supply for all means of actuation.
 - c. Time Delay (1 to 30 seconds) for normal cycle, as well as, the following built in features:
 - 1) Torque limiting for controlled forces on opening.
 - 2) Acceleration control for smooth starts and recycle.
 - 3) Special circuitry for reducing power to the motor when door is in HOLD-OPEN mode, extending longevity and assuring reliability.
 - d. Provide all sensors, actuators and controls.
 - e. Provide automatic lock interface for single or pairs of door for electrified exit devices, delayed egress magnetic locks and door electric strike applications.
 - f. Provide any additional interface options to operate door with the access control devices.
 - g. Provide additional items required for compliance with ANSI/BHMA-A156.10.

2.5 LOW ENERGY DOOR OPERATORS

- A. General:
 - 1. Operator complying with ANSI/BHMA 156.19.
 - 2. Electro-mechanical operator, powered by Minimum 1/8 HP, continuous duty.
 - a. Voltage: 110-120 VAC; <10 Amp.
 - 3. Factory-assembled, and sealed unit including helical gear drive transmission and interconnected rack and gear system for compression heavy duty spiral spring.
 - a. Housing enclosure: Die cast aluminum housing.
 - b. Spring: Replaceable.
 - c. Mount operator using vibration isolators.
 - 4. Operation:
 - a. Power-open/Spring-close.
 - b. Operate as door closer in event of power failure.
 - c. Include safe swing circuit that slows door if sensing device is activated while door is in operating cycle.
 - d. Both OPEN and CLOSE speeds adjustable.
 - e. Include clutch that permits frequent manual use of opening without detrimental wear on operator.

5. Electronic Controls:
 - a. Self-contained, solid state integrated circuit controlling operation and switching of the operator.
 - b. Integral low voltage power supply for all means of actuation.
 - c. Time Delay (1.5 to 30 seconds) for normal cycle, as well as, the following built in features:
 - 1) Torque limiting for controlled forces on opening.
 - 2) Acceleration control for smooth starts and recycle.
 - 3) Special circuitry for reducing power to the motor when door is in HOLD-OPEN mode, extending longevity and assuring reliability.
 - d. Provide all sensors, actuators and controls.
 - e. Provide automatic lock interface for single or pairs of door for electrified exit devices, delayed egress magnetic locks and door electric strike applications.
 - f. Provide any additional interface options to operate door with the access control devices.
 - g. Provide additional items required for compliance with ANSI/BHMA-A156.19.
 - h. Base Product: SW100 by Besam.
 - 1) Optional Products include: 7000 Series Horton, Magic Force by Stanley.
- B. Types of Low Energy Door Operators:
 1. LPO Low Energy Operator:
 - a. Complying with ANSI/BHMA 156.19 and used on non-fire rated openings.
 2. LPO/FDO Low Energy Fire Door Operator:
 - a. Complying with ANSI/BHMA 156.19 and used on fire rated openings.
 - b. Operators and components complying with NFPA 80 a certified by a nationally recognized testing laboratory.
 - c. Function - Fire Alarm
 - 1) Disconnect from power source by Fire Alarm.
 - 2) Self-close and self-latch by Fire Alarm.
 - 3) Operators shall not re-open doors until Fire Alarm has been reset.
 - d. Function - Loss of Power: Self-close and self-latch upon loss of power.

2.6 OPERATOR FINISHES SCHEDULE

- A. Interior Operators:
 1. Finish on exposed components: Clear anodic finish, Class I.
- B. Exterior Operators:
 1. Finish on exposed components: Clear anodic finish, Class I.

2.7 ACTUATION DEVICES

- A. Wall switches (WS):
 1. Momentary contact type.
 2. Narrow Style for direct mount on jambs:
 - a. Base Product: PBJ by BEA.
 3. Finish: 630.
 4. Mount center line of switch 44 IN above floor.
 5. Locate as indicated or directed.
 6. Wall switch with universal accessibility symbol.
 7. Decals defining direction of door swing.
 - a. Base Product: PBR by BEA.
- A. On/Off Switch:
 1. Toggle switch:
 - a. Mount on operator housing.

2.9 FABRICATION

- A. Factory fabricate automatic door operators to comply with indicated standards.
- B. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within operator enclosure to the exterior.
- C. Form aluminum shapes before finishing.
- D. Use concealed fasteners to greatest extent possible.
 - 1. Where exposed fasteners are required, use countersunk phillips flat head machine screws, finished to match operator.
- E. Fabricate metal cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors. Factory finish.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Perform complete installation of automatic door control equipment.
- B. Include electrical connections between components.
- C. Coordinate control wiring with electrical installer.
- D. Coordinate operation with card access system.
- E. Leave work ready to operate.

END OF SECTION

SECTION 08 81 02
EXTERIOR GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Exterior Glass And Glazing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Glass standards:
 - 1. Flat glass ASTM-C1036.
 - a. Float glass: Type I, Quality q3; and Class 1 unless otherwise indicated.
 - b. Figured glass: Type II, Quality q7, Form 3; and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
 - c. Provide Class 2 or 3 for tinted or integrally colored glass.
 - 2. Flat glass, heat treated (coated/uncoated) ASTM-C1048.
 - a. Heat strengthened glass: Kind HS, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
 - b. Tempered glass: Kind FT, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
 - c. Heat soak tested.
 - d. Provide Class 2 or 3 for tinted or integrally colored glass.
 - e. Provide Condition B or C for coated glass.
 - 3. F.S.DD-M-00411B(1).
 - 4. NFPA-80 Standard for Fire Doors and Windows.
 - 5. Insulating Glass Units:
 - a. Insulating Glass Certification Council (IGCC), Class CBA.
 - b. ASTM-E2190: Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - c. ASTM-E2188: Standard Test Method for Insulating Glass Unit Performance.
 - d. ASTM-E2189: Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 6. ANSI Z97.1.
 - 7. CPSC 16 CFR 1201.
 - 8. GANA Glazing Manual.
- B. Glazing standards:
 - 1. "Glazing Manual", by the Glass Association of North America (GANA) .
 - 2. "Glazing Guidelines for Sealed Insulating Glass Units", by the Insulating Glass Manufacturers Alliance (IGMA).

1.3 LEED INFORMATION:

- 1. Credit MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. Credit MR 5.1 & 5.2 –Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 SUBMITTALS

- A. Samples:
 1. 12 IN x 12 IN, of each specified type of glass.
- B. Contract closeout information:
 1. Warranty.

1.5 WARRANTY

- A. Written five (5) year warranty signed by installer to cover weather tightness of installation including air and water integrity.
- B. Written warranty signed by manufacturer or fabricator of glass units against failure.
 1. Failure: Deterioration due to normal conditions, thermal failure of insulating units, or obscured vision.
 - a. Coated glass: 10 year.
 - b. Laminated glass: 5 year.
 - c. Insulating glass (vertical): 10 year.
 - d. Insulating glass (sloped): 5 year.
 - e. Reflective spandrel: 5 year.
 - f. Pyrolytic-Coated, Self-Cleaning Glass: 10 years.
 - g. Tempered glass: Heat soaked warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Insulating glass and insulating spandrel glass fabricators:
 1. Base:
 - a. Guardian
 2. Optional:
 - a. Viracon
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Glass:
 1. Comply with indicated standards.
 2. See Glass Types Schedule for listing of types.
 3. Materials specified in Glass Types Schedules are minimum acceptable products.
 4. Single manufacturer produce individual glass types used in fabrication of insulating units.
 5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.
 6. Low-E coating:
 - a. Soft-coat.
- B. Glazing compounds:
 1. Nonsag, nonstain type.
 2. Pigmented to match frame units not requiring painting.

3. Compatible with adjacent surfaces.
 4. For use in setting glass: Neutral-cure Silicone sealant.
 5. Sealant tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
 6. Gaskets:
 - a. Polyvinyl chloride or neoprene.
 - b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.
- C. Installation setting blocks and spacers:
1. Neoprene, compatible with sealants used.
 2. Setting blocks: 80-90 durometer.
 3. Spacers: 40-50 durometer.
 4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
- D. Insulating glass spacers:
1. Aluminum, desiccant filled.
 - a. Finish: Mill.
- E. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

2.3 GLASS TYPES SCHEDULE

- A. Glass Type EX-1, Clear float:
1. Clear float, 6mm thick.
- B. Glass Type EX-2, Clear tempered:
1. Clear, tempered tongless float, 6 mm thick.
- C. Glass Type EX-3, Ultra clear low-iron, 6mm thick.
1. Base: Guardian UltraWhite.
- D. Glass Type EX-4, Ultra clear low-iron, 6 mm thick, tempered:
1. Ultra clear low-iron, tempered tongless, 6mm thick.
 2. Base: Guardian UltraWhite.
- E. Glass Type EX-5, Acid-etched tempered, 6 mm thick:
1. Base: Guardian SatinDeco.
- F. Glass Type EX-10A: (Exterior glazing on the Ground and First Floor levels where safety glazing EX-10B is not required).
1. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-3 with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard SN 68.
 3. Inside glass: Glass Type EX-3.
 4. Minimum performance of insulated glass unit:
 - a. Visible Light %: 69
 - b. Winter U-value: 0.29
 - c. Summer U-value: 0.28
 - d. SHGC: 0.38
 5. Desired Appearance: Transparent in both directions.
- G. Glass Type EX-10B: (Exterior glazing on the Ground and First Floor levels where safety glazing is required).
1. Required locations:
 - a. Lites located within 2 FT of a floor surface or grade.
 - b. Lites located within 2 FT of a door.
 - c. Additional locations as noted on drawings.

2. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 3. Outside glass: Glass Type EX-4 with low E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard SN 68.
 4. Inside glass: Glass Type EX-4.
 5. Minimum performance of insulated glass unit:
 - a. Visible Light %: 69
 - b. Winter U-value: 0.29
 - c. Summer U-value: 0.28
 - d. SHGC: 0.38
 6. Desired Appearance: Transparent in both directions.
- H. Glass Type EX-11A: (Exterior insulated glazing on North Façade of Second and Third Floor levels where safety glazing EX-11B is not required).
1. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-3 uncoated.
 3. Inside glass: Glass Type EX-3 uncoated.
 4. Minimum performance of insulated glass unit:
 - a. Visible Light %: 82
 - b. Winter U-value: 0.47
 - c. Summer U-value: 0.50
 - d. SHGC: 0.80
 5. Desired Appearance: Ultra transparent in both directions.
- I. Glass Type EX-11B: (Exterior insulated glazing on North Façade of Second and Third Floor levels where safety glazing is required).
1. Required locations:
 - a. Lites located within 2 FT of a floor surface or grade.
 - b. Lites located within 2 FT of a door.
 - c. Additional locations as noted on drawings.
 2. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 3. Outside glass: Glass Type EX-3 uncoated.
 4. Inside glass: Glass Type EX-4 uncoated.
 5. Minimum performance of insulated glass unit:
 - a. Visible Light %: 82
 - b. Winter U-value: 0.47
 - c. Summer U-value: 0.50
 - d. SHGC: 0.80
 6. Desired Appearance: Ultra transparent in both directions.
- J. Glass Type EX-12A: (Exterior insulated glazing on South, East, and West Facades of Second and Third Floor levels where safety glazing EX-12B is not required).
1. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-1 with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard AG 43.
 3. Inside glass: Glass Type EX-1 with low-E coating on #3 surface.
 - a. Low-E coating Base: Guardian SunGuard SN 68.
 4. Minimum performance of insulated glass unit:
 - a. Visible Light %: 34
 - b. Winter U-value: 0.29
 - c. Summer U-value: 0.27
 - d. SHGC: 0.24
 5. Desired Appearance: Transparent from interior to exterior. Reflective on exterior.

- K. Glass Type EX-12B: (Exterior insulated glazing on South, East, and West Facades of Second and Third Floor levels where safety glazing is required on interior side only).
1. Required locations:
 - a. Lites located within 2 FT of a floor surface.
 - b. Additional locations as noted on drawings.
 2. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 3. Outside glass: Glass Type EX-1 with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard AG 43.
 4. Inside glass: Glass Type EX-2 with low-E coating on #3 surface.
 - a. Low-E coating Base: Guardian SunGuard SN 68.
 5. Minimum performance of insulated glass unit:
 - a. Visible Light %: 34
 - b. Winter U-value: 0.29
 - c. Summer U-value: 0.27
 - d. SHGC: 0.24
 6. Desired Appearance: Transparent from interior to exterior. Reflective on exterior.
- L. Glass Type EX-12C: (Exterior insulated glazing on South, East, and West Facades of Second and Third Floor levels where safety glazing is required both sides).
1. Required locations:
 - a. Lites located within 2 FT of a floor surface and adjacent to an exterior terrace or walking surface.
 - b. Additional locations as noted on drawings.
 2. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 3. Outside glass: Glass Type EX-2 with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard AG 43.
 4. Inside glass: Glass Type EX-2 with low-E coating on #3 surface.
 - a. Low-E coating Base: Guardian SunGuard SN 68.
 5. Minimum performance of insulated glass unit:
 - a. Visible Light %: 34
 - b. Winter U-value: 0.29
 - c. Summer U-value: 0.27
 - d. SHGC: 0.24
 6. Desired Appearance: Transparent from interior to exterior. Reflective on exterior.
- M. Glass Type EX-12D: (Exterior insulated glazing on South Facade of Second and Third Floor levels at toilet rooms where obscured vision is required and safety glazing is desired on the interior side).
1. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-1 with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard AG 43.
 3. Inside glass: Glass Type EX-5 with acid etch on #3 surface.
 - a. Omit low-E coating from #3 surface.
 4. Minimum performance of insulated glass unit:
 - a. Visible Light %: 34
 - b. Winter U-value: 0.29
 - c. Summer U-value: 0.27
 - d. SHGC: 0.24
 5. Desired Appearance: Obscured vision from interior to exterior and from exterior to interior. Reflective on exterior.
- N. Glass Type EX-12E: (Exterior insulated glazing at upper lites of punched window openings on South, East, and West Facades at Second and Third Floor levels as indicated on drawings).

1. Insulating glass; two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-1 with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard AG 43.
 3. Inside glass: Glass Type EX-1 with ceramic frit (silkscreened) dot pattern on #3 surface.
 - a. Omit low-E coating from #3 surface.
 4. Minimum performance of insulated glass unit:
 - a. Visible Light %: 34
 - b. Winter U-value: 0.29
 - c. Summer U-value: 0.27
 - d. SHGC: 0.24
 5. Ceramic Frit (Silkscreened) Pattern:
 - a. 1/8 IN dot pattern; 40% coverage.
 - b. Dot pattern to run off edge of glass – no clear or solid borders.
 - c. Color: To be selected by Architect from Manufacturer's standard colors.
 6. Desired Appearance: Transparent from interior to exterior. Reflective on exterior. Silk screened pattern to be visually inconspicuous while reflecting solar energy.
- O. Glass Type EX-13 - Laminated Skylight Glazing:
1. Insulating glass: two sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: 6 mm thick, Glass Type 1 heat strengthened with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard AG 43.
 3. Inside glass: Two pieces of 3mm thick, clear, heat strengthened glass laminated together with low-E coating on #3 surface.
 - a. Interlayer: 60 mil.
 - b. Low-E coating Base: Guardian SunGuard SN 68.
- P. Glass Type EX-14A – Spandrel Glazing (at all elevations of Ground and First Floor levels).
1. Insulated Spandrel Glass; two sheets of 6 mm thick heat strengthened float glass hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-4 with low E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard SN 68.
 3. Inside glass: 6 mm thick, ceramic frit on 3rd surface.
 4. Ceramic frit color: To be selected by Architect from Manufacturer's standard colors.
- Q. Glass Type EX-14B – Spandrel Glazing (at North Façade of Second and Third Floor levels).
1. Insulated Spandrel Glass; two sheets of 6 mm thick heat strengthened float glass hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-3 uncoated.
 3. Inside glass: 6 mm thick, ceramic frit on 3rd surface.
 4. Ceramic frit color: To be selected by Architect from Manufacturer's standard colors.
- R. Glass Type EX-14C – Spandrel Glazing (at South, East, and West Facades of Second and Third Floor levels)
1. Insulated Spandrel Glass; two sheets of 6 mm thick heat strengthened float glass hermetically sealed together at edges with spacers and sealant, with 1/2 IN argon-filled space.
 2. Outside glass: Glass Type EX-1 with low-E coating on #2 surface.
 - a. Low-E coating Base: Guardian SunGuard AG 43.
 3. Inside glass: 6 mm thick, ceramic frit on 3rd surface.
 4. Ceramic frit color: To be selected by Architect from Manufacturer's standard colors.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.
- B. Field verify glass size for each opening, within tolerances and dimensions established.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Comply with GANA Glazing Manual and IGMA Glazing Guidelines for Sealed Insulating Glass Units.
- C. Do not install glass with edge damage.
- D. Install setting blocks in adhesive or sealant.
- E. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- F. Minimum Bite:
 - 1. Monolithic, 1/4 IN, Glass: 3/8 IN.
 - 2. 1 IN Insulating units: 1/2 IN.
 - 3. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass & Glazing.
- G. Sealant Depth: Equal to sealant width.
- H. Miter cut and bond gasket ends together at corners.
- I. Remove and replace damaged glass.
- J. Ensure that weep system in frames is not blocked by sealant.

3.3 CLEANING AND PROTECTION

- A. Wash and polish glass on both faces not more than 7 days prior to final completion of work.
- B. Comply with glass manufacturer's recommendations and "GANA 01-0300".

END OF SECTION

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SECTION 08 81 04
INTERIOR GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Interior Glass And Glazing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Glass standards:
 - 1. ANSI Z97.1.
 - 2. CPSC 16 CFR 1201.
 - 3. GANA Glazing Manual.
- B. Flat glass ASTM-C1036.
 - 1. Float glass: Type I, Quality q3; and Class 1 unless otherwise indicated.
 - 2. Figured glass: Type II, Quality q7, Form 3; and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
 - 3. Mirror glass and one-way vision glass: Type I, Quality q1 or q2, Class 1, and coated for purpose.
- C. Flat glass, heat treated (coated/uncoated) ASTM-C1048.
 - 1. Heat strengthened glass: Kind HS, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
 - 2. Tempered glass: Kind FT, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
- D. Mirror Glass:
 - 1. ASTM-C1503;
 - 2. Quality: Mirror select.
 - 3. F.S.DD-M-00411B (1).
- E. Fire-Rated Assemblies:
 - 1. General:
 - a. Where glazing products are used in fire-rated assemblies, comply with requirements of specific assembly specified in other sections of these Specifications.
 - b. Underwriters Laboratories, Inc. (UL):
 - 1) UL 9 – Fire Tests of Window Assemblies.
 - 2) UL 10B – Fire Tests of Door Assemblies.
 - 3) UL 10C – Positive Pressure Fire Tests of Door Assemblies.
 - c. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.
 - 2. Door Assemblies:
 - a. Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - b. Positive Pressure Compliance: UL 10C.
 - c. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E2074-00 and UL 10B, labeled and listed by UL.
 - 3. Window Assemblies:

- a. Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
 - b. Positive Pressure Compliance: UL 10C.
- F. Laminated Glass:
- 1. Laminated Glass: ASTM-C1172.
 - 2. "Laminated Glass Design Guide", by the Glass Association of North America (GANA).
- G. Glazing standards:
- 1. "Glazing Manual", by the Glass Association of North America (GANA).

1.3 SUBMITTALS

- A. Samples:
- 1. 12 IN x 12 IN, of each specified type of glass.
- B. LEED Information:
- 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.

1.4 JOB CONDITIONS

- A. Do not proceed with installation under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations.

1.5 WARRANTY

- A. General: Written warranty signed by manufacturer or fabricator:
- B. Coated Glass:
- 1. 10 years against defects such as peeling, cracking, and other indications of degradation of metallic coating.
- C. Laminated Glass:
- 1. 5 years against deterioration including edge separation, delamination that materially obstructs vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- D. Fire-rated Ceramics:
- 1. 5-year manufacturer's warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fire-rated Glass Ceramic:
- 1. Base:
 - a. Technical Glass Products.
 - 2. Optional:
 - a. Safti.

2.2 MATERIALS

- A. Glass materials:
 - 1. Comply with indicated standards.
 - 2. See Glass Types Schedule for listing of types.
 - 3. Materials specified in Glass Types Schedules are minimum acceptable products.
 - 4. Single manufacturer produce individual glass types used in fabrication of insulating units.
 - 5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.
- B. Glazing compounds:
 - 1. Nonsag, nonstain type.
 - 2. Pigmented to match frame units not requiring painting.
 - 3. Compatible with adjacent surfaces.
 - 4. For use in setting glass: Neutral-cure Silicone sealant.
 - 5. Sealant tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
 - 6. Gaskets:
 - a. Polyvinyl chloride or neoprene.
 - b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.
- C. Installation setting blocks and spacers:
 - 1. Neoprene, compatible with sealants used.
 - 2. Setting blocks: 80-90 durometer.
 - 3. Spacers: 40-50 durometer.
 - 4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
- D. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.
- E. Sealants, where applied, shall have a VOC content no greater than 250 g/L.

2.3 GLASS TYPES SCHEDULE – GENERAL REMARKS

- 1. Refer to Interior Glass Types Schedule for basic description of Mark Numbers indicated on Drawing.
- 2. Refer to Drawings for depiction of unit sizes and locations.
- B. Upgrade basic type conditions in accordance with following rules:
 - 1. Heat treatment upgrade based on physical size of unit:
 - a. Units between and 70 SF may be heat strengthened or fully tempered.
 - b. Units exceeding 70 SF shall be fully tempered.
 - c. Units which exceed length or width limitations or both for annealed glass shall be strengthened as recommended by glass manufacturer.
 - 2. Heat treatment upgrade based on locations which are potentially hazardous to occupants:
 - a. Upgrade units to fully tempered (Kind FT) glass as required by any one of following:
 - 1) When required by local Codes.
 - 2) When specifically indicated on Drawings.
 - 3) Locations requiring Safety Glass (Kind FT) by 16 CFR 1201 and ANSI Z97.1:
 - a) Units installed in doors, sash, transom or other operable units.
 - b) Units where any part of unit is within 18 IN (measured vertically) above a floor line, sidewalk, paver, or other walking surface located within 3 FT of the glass unit, (measured horizontally.)
 - 4) Units in sidelights and other units located adjacent to and within 48 IN of either jamb of door or other operable units; this includes adjacent lites that are in perpendicular plane to door.
 - 3. Other conditions requiring heat treatment upgrades:

- a. Units which will be exposed to irregular sun or shade combinations or both shall be Kind HS or better.
- b. Where glass manufacturer recommends heat treatment coatings or tints specified.
- c. Where required to resist lateral loads.

2.4 INTERIOR GLASS TYPES SCHEDULE

A. Type "A" - Annealed:

1. Clear float, 1/4 IN (6mm) thick.

B. Type "T" - Tempered:

1. Clear, fully-tempered tongless float, 1/4 IN (6 mm) thick.

C. Type "T1" – Tempered:

1. Clear, fully-tempered tongless float, 3/8 IN (9 mm) thick.

D. Type "C8" – 8mm Ceramic, Laminated Fire & Safety Glass:

1. Laminated, wireless, UL labeled for assembly indicated.
2. Impact-Safety Rated per ANSI Z93.1 and CPSC 16CFR1201.
3. Thickness: 8mm, laminated.
4. Surface: Polished.
5. Base Product: "FireLite Plus" by Technical Glass Products.

E. Type "M" – Mirror(s):

1. Color: Clear.
2. Thickness: 1/4 IN (6 mm).
3. Temper:
 - a. Tempered.
4. Provide units beveled on edges.
 - a. Unit Length(s) and Width(s): As indicated on drawings.

F. Type "D" – Decorative:

1. Tempered tongless float
 - a. Manufacturer: Skyline Design
 - b. Style: "Custom Etch Pattern" with Skyline Etch Sealer, bottom to top fade
 - 1) Full frost up to 5'-6" AFF, fade to begin at 5'6" and result in clear at top.
 - c. Tempered
 - d. Thickness: 1/4IN (6 mm).

G. Type "D1" – Decorative:

1. Tempered tongless float
 - a. Manufacturer: Skyline Design
 - b. Style: "Custom Etch Pattern" with Skyline Etch Sealer, bottom to top fade
 - 1) Full frost up to 5'-6" AFF, fade to begin at 5'6" and result in clear at top.
 - c. Tempered
 - d. Thickness: 3/8IN (9 mm).

H. Type "DM" – Decorative Magnetic:

1. Low-iron PPG Starphire tempered glass with magnetic backer
 - a. Manufacturer: Skyline Design
 - b. Style: "Vitracolor Magnetic/Game Grid pattern" #85870-003
 - 1) Custom colored "dots" to match Benjamin Moore – Creekbed #1006.
 - 2) Grid pattern to align and be continuous across panels.
 - c. Thickness: 1/4 IN (6 mm).
 - d. Sizes: See elevations for size information.
 - e. Accessories: Supply U-shaped stainless steel magnetic marker tray.
 - 1) Marker tray to run full width of wall with DM glass.
 - 2) Mount at 36" AFF.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

3.2 INSTALLATION

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.
- D. As a minimum, comply with GANA Glazing Manual and IGMA Glazing Guidelines for Sealed Insulating Glass Units.
- E. Install sealants as recommended by sealant manufacturer.
- F. Install setting blocks in adhesive or sealant.
- G. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- H. Minimum Bite:
 - 1. Monolithic, 1/4 IN, Glass: 3/8 IN.
 - 2. 1 IN Insulating units: 1/2 IN.
 - 3. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass & Glazing.
- I. Sealant Depth: Equal to sealant width.
- J. Prevent sealant exudation from glazing channels.
 - 1. Leave void at heel (or install filler) at jambs and head.
 - 2. Do not leave void (or install filler) at sill.
- K. Miter cut and bond gasket ends together at corners.
- L. Immediately after installation, attach crossed streamers to framing held away from glass.
- M. Do not apply anything to surfaces of glass.
- N. Install spandrel units from exterior of building.
- O. Remove and replace damaged glass.
- P. Installation of Mirrors:
 - 1. Mastic Attachment: Install mirrors with mirror adhesive applied to back of mirror and pressed against substrate as recommended by mirror supplier.

3.3 CLEANING AND PROTECTION

- A. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.
- B. Comply with glass manufacturer's recommendations and "GANA 01-0300".

END OF SECTION

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SECTION 08 91 00
ARCHITECTURAL LOUVERS (Revised AD-1)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for all Architectural Louvers, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Air Movement and Control Association (AMCA) certification.

1.3 STRUCTURAL PERFORMANCE CRITERIA

- A. Design Criteria: Provide units which are capable of withstanding the effects of loads and stresses from wind and normal thermal movement without permanent deformation of members or fasteners.
- B. Structural Design Criteria:
 - 1. Design louver systems and anchorage to meet Design Load.
 - a. Wind Loads – Use greater of the following:
 - 1) Wind Pressures listed on Design Requirements on Structural Drawings.
 - 2) Wind Pressures defined by Building Code as locally adopted and amended.
 - 3) 20 PSF Minimum.
- C. Thermal Movements:
 - 1. Ambient Temperature Change: 120 degF.
 - 2. Material Surface Temperature Change: 180 degF.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Performance data bearing AMCA certified ratings for air flow, water penetration, free area, and other listed criteria specified.
- B. Shop drawings.
 - 1. Showing structural support and anchorage of louver assembly.
 - 2. Showing interface with adjacent wall construction.
 - 3. Showing connection details of louver sections.
 - 4. Showing pan flashings.
 - 5. Showing integral sub-frame.
- C. Samples:
 - 1. Finishes.
- D. Contract Closeout Information:
 - 1. Warranty.
- E. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.5 WARRANTY

- A. Manufacturer's standard twenty (20) year warranty for PVDF finish.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Architectural Louvers:
 1. Base:
 - a. Airolite.
 2. Optional:
 - a. Air Flow Company, Inc.
 - b. Airline Products.
 - c. Industrial Louvers.
 - d. Reliable Products.
 - e. Ruskin Manufacturing.
 - f. C/S Group.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 1. Frame and Blade Material:
 - a. 6063-T5, Extruded aluminum.

AD-1:

2. Bird screen: Deleted
 3. Painted Finish:
 - a. Factory primed and painted with coats of Kynar 500 (70% PVDF).
 - 1) Oven-cured.
 - 2) 3-coat system complying with AAMA 2605.
 - 3) Color:
 - a) Custom Color: To match selected color of Penthouse wall panels.
 - b) Design Intent: Metallic color to closely resemble clear anodized finish.
 - 4) 20-year warranty on PVDF finish.
 4. Gang louver units together, where necessary or where indicated to makeup the overall sizes required.
- B. Sealant: See Section 07 92 13 for materials.
 - C. Accessories: Fabricate anchors, reinforcing, and required ancillary items of compatible material.

2.3 ARCHITECTURAL LOUVERS

AD-1:

- A. Louver Type #1: Refer to Section 07 42 16.
- B. Louver Type #2: 150mm 6 IN Deep Louver Screen (for use at rooftop equipment screen only).
 1. Louvers shall be inverted to screen mechanical equipment from a lower vantage point.
 2. Base Pro Frame Depth: 6 IN thick.
 3. Minimum Wall Thicknesses (Frames and Blades): 0.081 IN thick.

4. Percent Free Area: 52%.
5. Unit Size(s): As indicated.
6. Base Product: "ENCB6096" by Airolite.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of openings to accept units.
- B. Correct unsatisfactory conditions.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations
- B. Install anchoring and bracing accessories as required.
- C. Install bird screens.
- D. Seal perimeter joints watertight.

END OF SECTION

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SECTION 09 06 10
ROOM FINISH AND COLOR SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Room Finish and Color Schedule, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DESCRIPTION

- A. Room Finish Schedule as follows shows material information only; see the following sheets for more specific information:
 - 1. See Reflected Ceiling Plans for ceiling heights and finishes and colors.
 - 2. See Interior Finish Plans (I-series) for floor and wall finishes and colors.
 - 3. See Wall protection Plans (IW-series) for location of all corner guards and wall guards.
 - 4. See Furniture Plans (IF-series) for type and location of furniture.
 - 5. See Casework Plans for location of casework.
 - 6. See specifications for product information.
-

LEGEND OF FINISHES AND COLORS

1.2 DESCRIPTION (CONTINUED)

- B. Schedule is for material location and color assignment only:
 1. Use in conjunction with the drawings and specifications.
 2. Bring any apparent error, inconsistency, or omission to the attention of the Architect before proceeding.
- C. Abbreviations: See section indicated for description of material.

ABBREVIATIONS FLOOR/BASE			
CT	Ceramic Tile	Section	09 30 00
PT	Porcelain Tile	Section	09 30 00
SMST	Stone Matrix Stair Treads	Section	09 30 41
RB	Resilient Base	Section	09 65 13
AD-4: Section 09 06 10: Delete 09 65 17			
LT	Limestone Tile	Section	09 65 17
RT	Resilient Tile	Section	09 65 19
RST	Resilient Stair Tread	Section	09 65 19
AD-4: Section 09 06 10: Add 09 65 20			
RFT	Rubber Floor Tile	Section	09 65 20
SDRF	Static Dissipative Resilient Flooring	Section	09 65 36
TERR	Thin-Set Epoxy Terrazzo	Section	09 66 23
CFS-ND	Concrete Floor Sealer (Normal Duty)	Section	09 67 81
CFS-HD	Concrete Floor Sealer/Hardener	Section	09 67 83
CPT	Carpet Tile	Section	09 68 13
EG	Entrance Grid	Section	12 48 23
NET	Nylon Entrance Tile	Section	12 48 26
WALLS			
MP	Carpentry - Metal Paneling	Section	06 10 53
RFWP	Reclaimed Flush Wood Paneling	Section	06 42 14
CT	Ceramic Tile	Section	09 30 00
PT	Porcelain Tile	Section	09 30 00
GT	Glass Tile	Section	09 30 00
DWC	Dry Erase Wall Covering	Section	09 72 33
PNTLO	Paint (low odor)	Section	09 91 23
WG	Wall Guard	Section	10 26 00
CEILINGS			
GWB	Gypsum Wallboard	Section	09 29 00
AM	Acoustical & Ceiling Tile Material	Section	09 51 00
CG	Ceiling Grid	Section	09 51 00
WCS	Wood Ceiling System	Section	09 54 27
PNTLO	Paint (low odor)	Section	09 91 23
MISCELLANEOUS			
CG	Corner Guard	Section	10 26 00
PL	Plastic Laminate	Section	12 34 00
RFG	Recycled Glass PCC Countertops	Section	12 36 37

- D. General notes:
1. Aesthetics are a very important part of this project:
 - a. Any proposed change impacting appearance requires submittal of a substitution request
 - 1) Substitution prior to bid: See Section 00 22 00
 - 2) Substitution during construction: Section 01 25 13
 2. Provide consistent material colors and patterns in each room or area.
 - a. If required for consistency, provide materials from same production run.
 3. Samples:
 - a. In accordance with the Construction Documents, provide three samples of each color and material as required for approval. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.
 - b. On actual wood surfaces, provide three 4 IN x 8 IN samples of natural and stained wood finishes. Label and identify each as to location and application.
 4. Typical finishes:
 - 1) GWB to ceiling above wall mounted architectural casework: Match adjacent walls unless indicated otherwise
 - 2) GWB Column Covers: Match adjacent walls
 - 3) GWB Soffits
 - a) Vertical surfaces: Match adjacent walls
 - b) Bottom surfaces: Ceiling White
 - h. Hollow metal doors, hollow metal frames, Type/color: PNTLO-2 unless otherwise indicated. Section 09 91 23
 5. Paint:
 - a. Where items or surfaces are not specifically mentioned, bring to attention of Architect. Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as, but not limited to, metal toilet enclosures, pre-finished partition systems, acoustic materials, architectural woodwork and casework, Stainless Steel elevator entrance doors and frames, including light fixtures, switchgear and distribution cabinets.
 - b.
 - c. Grills, diffusers, electrical panels, access panels, etc., which are exposed in finish spaces shall be painted to match the surface on which they occur.
 - 1) Paint interior surfaces of ducts flat black where surfaces are visible through grills or diffusers.
 - d. Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plated, copper, bronze and similar finished materials will not require finish painting.
 6. Flooring:
 - a. Coordinate with concrete curing method, see Section 03 31 10
 - b. Provide water vapor emission control system for concrete with applied flooring, see Section 09 60 05
 - c. Where Control Joints pass behind Rubber, Resilient Vinyl, Wood or other Wall Base, caulk Control Joint using a color which matches the color of the Base, prior to installing Base.
- E. Schedule of Elevator Cab Finishes:
1. Flooring:
 - a. Elevator # 1:
 - 1) TERR-1, Specified in Section 09 66 23.
 - b. Elevator #2:
 - 1) TERR-2, Specified in Section 09 66 23.
 2. Wall Finishes:
 - a. See A-400 series elevations for design, details and material information
 3. Ceiling Finishes:
 - a. As Specified in Division 14.
- F. Schedule of Stair Finishes @ Enclosed Stairs (does not apply to Lobby Stairs):
1. Landings: RST-1
 2. Landing Base: RB-1
 3. Treads: RST-1
 4. Risers: RST-1
 5. Ceilings at top level: EXPOS
 6. Underside of stairs: EXPOS
 7. Railings: PNTLO-4
 8. Wall Finishes: PNTLO-1

<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Color</u>	<u>Series</u>	<u>Comments</u>
Resilient Stair Tread (RST)					
RST-1	Nora Rubber	Article 488	4881 Hematite	Norament Grano	Match color & texture at landings
<i>AD-4: Section 09 06 10: Add 09 65 20 Rubber Floor Tiles RFT-1, RFT-2 and RFT-3</i>					
Rubber Floor Tiles (RFT)					
<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Color</u>	<u>Weld Rod</u>	<u>Series</u>
RFT-1	Nora Rubber	Art.2463	2786 Russian Cypress	To match	Envirocare 3.0mm
RFT-2	Nora Rubber	Art.2463	2931 Smoky Fennel	To match	Envirocare 3.0mm
RFT-3	Nora Rubber	Art.2463	2962 Cinnamon Bark	To match	Envirocare 3.0mm
Static Dissipative Resilient Flooring (SDRF)					
<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Color</u>	<u>Weld Rod</u>	<u>Series</u>
SDRF-1	Johnsonite	714	Misty	1287415	Granit SD
SDRF-2	Johnsonite	712	Smoky	1287413	Granit SD
SDRF-3	Johnsonite	718	Cool Breeze	1287419	Granit SD
Thin-Set Epoxy Terrazzo (TERR)					
<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Color</u>	<u>Series</u>	<u>Comments</u>
TERR-1	T & M Supply	TBD	See Spec 09 66 23		
TERR-2	T & M Supply	TBD	See Spec 09 66 23		
Concrete Floor Sealer - Normal Duty (CFS-ND)					
<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Finish</u>		
CFS-ND	See Spec	See Spec	See Spec		
Concrete Floor Sealer/Hardener (CFS-HD)					
<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Finish</u>		
CFS-HD	See Spec	See Spec	See Spec		
Carpet Tile (CPT)					
<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Color</u>	<u>Series</u>	<u>Layout</u>
CPT-1	Shaw Contract Group	59596-95761	Layered	Blur Tile	Brick
CPT-2	Shaw Contract Group	59011-95761	Layered	Laser Cut Tile	EcoWorx PX
CPT-3	Shaw Contract Group	59596-95103	Illuminate	Blur Tile	EcoWorx PX
CPT-4	Shaw Contract Group	59011-95103	Illuminate	Laser Cut Tile	EcoWorx PX
CPT-5	Shaw Contract Group	59596-95750	Blend	Blur Tile	EcoWorx PX
CPT-6	Shaw Contract Group	59011-95750	Blend	Laser Cut Tile	EcoWorx PX
CPT-7	Shaw Contract Group	59596-95330	Coutour	Blur Tile	EcoWorx PX
CPT-8	Shaw Contract Group	59011-95330	Coutour	Laser Cut Tile	EcoWorx PX
Dry Erase Wall Covering (DWC)					
<u>Code</u>	<u>Manufacturer</u>	<u>Manufacturer #</u>	<u>Color</u>	<u>Size</u>	<u>Slve</u>
DWC-1	Wolf Gordon	G 7223757	White	54" Width	EganWall Projection EWP54

AD-4: Section 09 06 10: Revise PNTLO-18, Add PNTLO-19

Section 09 91 23

Code	Manufacturer	Manufacturer #	Color	Finish	Comments
PNTLO-1	Glidden Professional	50YY 74/069	Meeting House	Eggshell	Neutral
PNTLO-2	Sherwin Williams	SW6108	Latte	Semi-Gloss	Trim Paint
PNTLO-3	Glidden Professional	--	Ceiling White	Flat	Ceiling Paint
PNTLO-4	Glidden Professional	30YY 56/060	Sea Gull Grey	Eggshell	Bathroom Paint
PNTLO-5	Glidden Professional	40YY 74/056	Southern Shadow	Eggshell	Ground Light
PNTLO-6	Benjamin Moore	2166-40	Soft Pumpkin	Eggshell	Ground Med
PNTLO-7	Pratt & Lambert	8-15	Orange Copper	Eggshell	Ground Dark
PNTLO-8	Glidden Professional	53YR 17/504	Winter's Silence	Eggshell	1st Light
PNTLO-9	Glidden Professional	50YY 49/191	Wooden Vest	Eggshell	1st Med
PNTLO-10	Pittsburgh Paints	412-4	Willow Tree	Eggshell	1st Dark
PNTLO-11	Pittsburgh Paints	412-5	Bravado Red	Eggshell	2nd Light
PNTLO-12	Sherwin Williams	6320	Red Bay	Eggshell	2nd Med
PNTLO-13	Sherwin Williams	6321	Orient Express	Eggshell	2nd Dark
PNTLO-14	Glidden Professional	96RR 08/311	Rain	Eggshell	3rd Light
PNTLO-15	Sherwin Williams	6219	Moody Blue	Eggshell	3rd Med
PNTLO-16	Sherwin Williams	6221	Still Water	Eggshell	3rd Dark
PNTLO-17	Sherwin Williams	6223	Tabrasa ULTRA Off White	N/A	Dry Erase Paint
PNTLO-18	MDC Wallcovering	TBU500W/4550	Wright Stone	Eggshell	
PNTLO-19	Glidden Professional	10YY 30/106			

Section 10 26 00

Code	Manufacturer	Color	Finish	Model #	Comments
WG-1	Alpar - de Terra	Cobblestone #0609	--	S-040	48" Height
CG-1	Alpar - de Terra	N/A	Stainless Steel	CG3-S	Full Height
CG-2	Alpar - de Terra	N/A	Stainless Steel	CG2-S	Full Height

Section 12 34 00

Code	Manufacturer	Manufacturer #	Finish	3mm Edge Banding	Comments
PL-1	Pionite	ST606	Suede	To Match	Break Rms
PL-2	Nevamar	S2066T	Textured	To Match	Tit Rms

Section 12 36 37

Code	Manufacturer	Series	Color/Pattern	Finish	Comments
RGF-1	Vetrazzo	N/A	Cubist Clear	High-Gloss Polished	
RGF-2	Stone Design	Ice Stone Series #77	White Pearl	Polished	

Section 12 48 23

Code	Manufacturer	Manufacturer #	Color	Size	Comments
EG-1	CS Acrovyn	101 - Standard	Stainless Steel	18" x 18"	Without Triangle Pattern

Section 12 48 26

Code	Manufacturer	Manufacturer #	Color	Size	Comments
NET-1	Lees	L6512 - 524	Stepping Stone	24" x 24"	

END OF SECTION

SECTION 09 21 27
EXTERIOR STUD WALL SYSTEM

PART 1 - GENERAL

1.1 DESIGN RESPONSILABORATORYILITY

- A. Provide engineering design performed and sealed by registered Structural Engineer (SE), licensed in the State of Illinois.
- B. Design Criteria:
 - 1. AISC Specifications for Design of Cold-Formed Steel Structural Members.
 - 2. Design Exterior Stud Wall System to satisfy requirements of applicable building codes as locally amended, but not less than the loads shown on the contract documents:
 - a. Design Exterior Soffits similarly.
 - b. Include all superimposed loads.
 - 3. Limit lateral deflection of stud wall system due to wind or earthquake as follows:

MAXIMUM ALLOWABLE DEFLECTION	
Exterior Finish Material	Deflection Limit
Stone Cladding	Smaller of L/600 or 0.3 IN
Metal Panels, Curtainwalls, and other flexible wall finishes.	L/360
Studs abutting windows or louvers.	1/4 IN

- 4. Select stud gauge and spacing as required to limit deflection due to applied loads:
 - a. Utilize strength properties of metal stud only.
 - b. Disregard contribution of facings such as Gypsum Wall Board and Gypsum Sheathing, which lose strength when wet.
- 5. Size and define headers reinforcing members around openings.
- 6. Develop details defining method of fastening throughout system.
- 7. Review and professionally seal submittals and calculations. Provide Engineer's stamp for the State of Illinois.
- 8. Connections:
 - a. Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J78 of the type, size, and location as shown on the drawings.
 - b. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.
 - c. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.
- C. Additional Criteria for Framing System for Exterior Soffits:
 - 1. In addition to gravity loads, design framing system to resist wind uplift.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Complete drawings prepared by manufacturer defining framing member sizes, locations, and connection details. Include plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes:

- a. Show connection details with screw types and locations, weld lengths and locations, and other fastener requirements.
 - b. Coordinate size of openings and support requirements for items installed in openings, with Contractor.
 - c. Show openings, edges and support conditions that have been field verified with respect to location.
 - d. Show openings, edges and support conditions that have coordinated with respect to physical requirements of items to be installed in or on exterior wall system.
2. Details and isometrics at windows showing layouts of Air Barrier Flashings and sequence of installation.
- B. Project information:
- 1. Catalog data indicating cross sectional properties.
 - 2. Structural calculations.
 - 3. Certification Exterior Stud Wall System has been designed, to satisfy specified design criteria, sealed by registered Engineer, licensed to practice Structural Engineering in the State of Illinois.
 - 4. Manufacturer and product name of sheathing.
- C. LEED Information:
- 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.

1.3 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
- B. Welding Qualifications:
- 1. Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code-Steel," and AWS D1.3, "Structural Welding Code-Sheet Steel."
- C. Fire-Test-Response Characteristics:
- 1. Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 65 00.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
- 1. Exterior metal studs:
 - a. Base:

- 1) Dietrich Industries (Worthington Industries).
 - b. Optional:
 - 1) Clarkwestern Building Systems.
 - 2) California Expanded Metal Products Co. (CEMCO).
 - 3) Allied Studco.
 - 4) Custom Stud Inc.
 - 5) Marino\WARE.
 - 6) The Steel Network.
 - 2. Sheathing:
 - a. Base:
 - 1) Georgia Pacific.
 - b. Optional:
 - 1) National Gypsum Company.
 - 2) USG.
 - 3) CertainTeed.
 - 4) Temple-Inland.
 - 3. Seam Sealant, for sheathing:
 - a. Base:
 - 1) Dow Corning.
 - b. Optional:
 - 1) Pecora.
 - 2) Tremco.
 - 3) Other manufacturers as recommended by maker of Sheathing.
 - 4. Galvanizing repair coating:
 - a. Base:
 - 1) Tnemec.
 - b. Optional:
 - 1) ZRC Worldwide.
- B. Metal Studs and Tracks:
- 1. Steel Quality:
 - a. Framing components shall conform to ASTM C955.
 - b. Steel: ASTM-A1003.
 - 2. Minimum Yield Strength: 33,000 PSI.
 - 3. Finish:
 - a. Prime with rust inhibitive, red oxide paint.
 - b. ASTM A653, Type SS, Grade 50, G-60 galvanized.
 - 4. Stud sizes:
 - a. Depth: As indicated.
 - b. Thickness: As determined by Structural calculations.
 - 5. Track Thickness: Not less than thickness required for studs.
 - a. Exception: Thinner track gauges may be used where demonstrated by structural calculations to be acceptable.
 - 6. Markings:
 - a. Studs and track shall have product markings stamped on the web of the section.
 - b. Markings shall be repeated throughout length of the member at a maximum spacing of 4 FT o.c. and shall be legible and easily read.
 - c. Product marking shall include the following:
 - 1) An ICBO number.
 - 2) Manufacturer's identification.
 - 3) Minimum delivered uncoated steel thickness.
 - 4) Protective coating designator.
 - 5) Minimum yield strength.

- C. Metal stud system accessories:
 - 1. Including:
 - a. Deflection clips and connectors.
 - b. Head-of-Wall deflection systems.
 - c. Rigid connectors.
 - d. Floor joist framing connectors.
 - e. Bridging, bracing, and backing systems.
 - f. Truss framing.
 - g. Fire-Rated connectors.
 - h. Specialty clips, connectors, and fasteners.
 - 2. As recommended by manufacturer.
 - 3. Provide horizontal bracing at not more than 4 FT o.c. or at mid span of 10 FT or less high walls.
 - 4. Provide lateral strap bracing and shear wall framing as indicated.

2.2 EXTERIOR METAL STUDS

- A. Exterior Studs:
 - 1. Galvanized steel studs, runner channels and track, bracing, and accessories, ASTM-A924 minimum G60 galvanized.
 - 2. Select members in accordance with Design Criteria.
 - 3. Stud depth(s): As indicated on Drawings.
 - 4. Span(s): As indicated on Drawings.
 - 5. Stud spacing: Maximum 16 IN OC; use closer spacing, 12 IN OC minimum, as needed to satisfy load deflection criteria.
 - 6. Stud Gauge: As determined for loads and deflection criteria.
 - a. Minimum thickness for Studs, Runners and Tracks: 43 mils (18 GA); use heavier thickness as needed to satisfy loading and deflection criteria.
 - 7. Minimum flange on Deep-Leg runners: 2 IN.
 - 8. Runner fasteners: Power driven fasteners to withstand minimum 190 LB shear and bearing.
 - 9. Headers: C-shapes used to form header beams, of web depths required and with stiffened flanges.
 - a. Gauges: As determined by engineering calculations for specific openings.

2.3 EXTERIOR GYPSUM SHEATHING

- A. General Description: Water-resistant, mold-resistant suitable for long term weather-exposure during construction.
 - 1. Comply with ASTM-C1177.
 - 2. Minimum Mold Resistance: 10 rating per ASTM-D3273.
 - 3. Minimum Thickness: 1/2 IN.
 - a. Provide 5/8 IN thick Type X product version where fire rated Exterior walls are indicated.
 - b. Soffit boards: Provide appropriate non-sag product where sheathing is used horizontally as in soffits.
 - 4. Base Products:
 - a. Description: Water-resistant treated gypsum core sheathing board with glass mat facers.
 - b. Approved products meeting this criteria:
 - 1) "Dens-Glass Gold Exterior Sheathing" by Georgia Pacific.
 - 2) "e²XP Extended Exposure Sheathing" by National Gypsum.
 - 3) "Securock Glass-Mat Sheathing" by USG.
 - 5. Optional Products:
 - a. Description: Facer-less, water-resistant treated gypsum core sheathing board with embossed drainage pattern on back.
 - b. Approved products meeting this criteria:
 - 1) "Fiberock Brand Sheathing, Aqua-Tough" by USG;

- 2) "GlasRoc Sheathing" by Certainteed.
- B. Seam Sealant/Fastener Head Sealant:
 - 1. Coordinate sealant for compatibility with selected air or vapor barrier systems and sheathing.
 - 2. Sealants applied inside building envelope shall have VOC content no greater than 250 g/L.
- C. Fasteners: Sized as required.
 - 1. Screws: Cadmium plated or stainless steel.
 - 2. Clips: Galvanized steel or zinc.
 - 3. Thread count as appropriate for stud materials specified.
- D. Sheathing accessories: Galvanized steel or zinc.

2.4 AIR BARRIER

- A. Insulation outboard of exterior sheathing:
 - 1. Air and vapor barrier, fluid applied, see Section 07 27 26.

2.5 OTHER MATERIALS

- A. Galvanizing repair coating: Tnemec "90-93" or ZRC Worldwide, "Galvilite".
- B. Gypsum wallboard (interior): Specified in Section 09 29 00.
- C. Insulation: Specified in Section 07 21 00.

PART 3 - EXECUTION

3.1 INSPECTION PRIOR TO INSTALLATION

- A. Examine substrate for suitability to accept work.
- B. Start of work constitutes acceptance of substrate and responsibility for performance.

3.2 ERECTION OF STUDS AND SHEATHING

- A. Install cold-formed framing in accordance with requirements of ASTM-C1007 and with applicable sections of the AISI Standard for Cold-Formed Steel Framing General Provisions.
- B. Comply with manufacturer's instructions.
- C. Openings: Install header, jamb, and sill framing system per approved engineering documents
- D. Studs and runners:
 - 1. Align outside deep leg runner track accurately according to exterior wall layout.
 - 2. Fasten at 12 IN OC, or as needed to satisfy design criteria.
 - 3. Position studs vertically in inside deep leg runners at required spacing.
 - 4. Install minimum of 2 studs each side of openings; use more if required to meet loadings.
 - 5. Anchorage:
 - a. Top:
 - 1) Allow 3/4 IN clearance between top of inside deep leg runner and outside deep leg runner.
 - 2) Do not fasten inside deep leg runner to outside deep leg runner.
 - 3) Fasten studs to inside deep leg runner.
 - b. Bottom:
 - 1) Anchor each stud at bottom to runners with two, 3/8 IN minimum, type S-12 pan head screws.
 - 6. Where stud design is outside edge of floor slab, provide galvanized connectors that satisfy loading requirements and allow individual floor movement to occur without affecting stud system integrity.

7. Shop weld assemblies as required to meet design requirements.
 - a. Retouch burned off or abraded galvanizing with galvanizing repair coating.
 8. Cut studs square and set with firm bearing against webs of top and bottom tracks.
 9. Position studs vertically in tracks and space as indicated in design.
 10. Do not splice studs.
- E. Remove oil residue from metal studs with detergent before installation of gypsum board or other finish material.
- F. Metal Wall Backing: Specified in Section 09 22 16.
1. Coordinate installation of metal wall backing used to support wall-supported items with installation of exterior stud wall system.
 2. See Section 09 22 16 for items requiring metal wall backing.
- G. Wood Wall Blocking: Specified in Section 06 10 53.
1. Coordinate installation of wood wall blocking used to support wall-supported items with installation of exterior stud wall system specified herein.
 2. See Section 06 10 53 for items requiring wood wall blocking.
- H. Exterior Sheathing:
1. Position sheathing so that edges of sheathing panels occur at stud centers.
 2. Screw to exterior of each stud as recommended by manufacturer.
 3. Butt sheathing boards together tightly:
 - a. Maximum gap between boards: 1/8 IN.
 - b. Seal seams and fastener heads with sealant per "Method 1" as described Georgia Pacific.
 4. Sheathing at Roof-side of parapet walls:
 - a. Apply sheathing on roof side of stud-framed parapet walls.
 - b. Sheathing is not required where parapet back-up walls are masonry.
- I. Exterior Ceilings and Soffits:
1. Control Joints;
 - a. Locate Control Joints in a manner that subdivides ceilings/soffits as indicated, and within the following limits: Subdivide so that no area exceeds 900 FT², and no area has a length which exceeds 30 FT.
 - b. Locate Control Joints at transitions between areas of different shapes.
 2. Finish System:
 - a. Tape joints with glass mesh tape.
 - b. Fill screw heads.
 - c. Apply skim coat over entire surface.
 3. Paint: Specified in Section 09 91 13.

3.3 FASTENING

- A. Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall comply as required and indicated in the design calculations.
1. Welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI SG02-1.
 - a. Welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M.
 - b. Welds shall be cleaned and coated with rust inhibitive galvanizing paint.
 - c. Do not field weld materials lighter than 18 GA.
 2. Screws shall be self-drilling self-tapping of the type, size, and location shown on the drawings.

- a. Screw penetration through joined materials shall not be less than three exposed threads.
 - b. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-1.
 - c. Screws covered by sheathing materials shall have low profile heads.
3. Anchors shall be of the type, size, and provided at locations shown on the drawings.

3.4 INSTALLATION OF AIR BARRIER

- A. Section 07 27 16.

3.5 FIELD QUALITY CONTROL

- A. Testing: Laboratory will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 PROTECTION

- A. Protect erected wall and openings with temporary covers until finish, roofing, flashing, and windows are installed.

3.7 REPAIRS

- A. Repair portions of sheathing that is damaged by rain, wind, or prolonged exposure.
- B. Repair portions of Air Barrier which are damaged by wind or prolonged exposure.
1. Damage shall include rips, tears, loss of adhesion of seam tape, and elongation of membrane at fastener penetrations.
- C. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

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Issued for Construction - 6/30/11

SECTION 09 22 16
NON-LOAD BEARING METAL STUD FRAMING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. General:
1. Where fire resistance classifications are indicated for walls or partitions: Provide studs and accessories of type tested and listed for construction indicated.
 2. Products proposed for use in fire-rated assemblies shall be approved by nationally recognized testing laboratory.
- B. ASTM Reference Standards:
1. ASTM-C645: Standard Specification for Nonstructural Steel Framing Members.
 2. ASTM-A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 3. ASTM-C754: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

1.2 PERFORMANCE REQUIREMENTS

- A. Select steel studs in accordance with the manufacturer's standard load tables and following Design Pressures and Maximum Deflections:

PERFORMANCE CRITERIA		
Use Condition ²	Design Pressure	Maximum Deflection¹
Wall enclosing stairs, elevator hoistways, and other vertical shafts	10 LBS/FT ²	L/120
Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions	15 LBS/FT ²	L/240
Walls scheduled with Cementitious Backer Board, Moisture-resistant, or Abuse-Resistant Gypsum Wallboard	15 LBS/FT ²	L/360
Walls scheduled to receive Tile, lath and plaster, or veneer plaster. ²		
Typical Interior Walls/Partitions (those not listed above)	5 LBS/FT ²	L/240
Interior Ceilings, Soffits and Bulkheads	5 LBS/FT ²	L/360
<p>Footnotes:</p> <p>1. Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath & Plaster, Simulated Masonry, Adhered-stone, Veneer Plaster and similar brittle finishes which are prone to movement-induced cracking.</p> <p>2. Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.</p>		

1.3 SUBMITTALS

- A. Project Information:
1. Manufacturer of listed products.

- B. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
1. Non-load Bearing Framing Components:
 - a. Base:
 - 1) Dietrich Industries (Worthington Industries).
 - b. Optional:
 - 1) ClarkWestern Building Systems.
 - 2) California Expanded Metal Products Co. (CEMCO).
 - 3) Allied Studco.
 - 4) Custom Stud Inc.
 - 5) Marino/WARE.
 - 6) The Steel Network.
 2. Framing for Gypsum Board Soffits and Ceilings:
 - a. Base:
 - 1) Dietrich Industries (Worthington Industries).
 - b. Optional:
 - 1) ClarkWestern Building Systems.
 - 2) California Expanded Metal Products Co. (CEMCO).
 - 3) Allied Studco.
 - 4) Custom Stud Inc.
 - 5) Marino/WARE.
 - 6) The Steel Network.
 3. Interlocking Grid Support Systems for Gypsum Board Ceilings:
 - a. Base:
 - 1) USG Corporation.
 - b. Optional:
 - 1) Chicago Metallic.
 - 2) Armstrong.

2.2 MATERIAL DESCRIPTION

- A. General:
1. Products proposed for use in fire-rated assemblies shall be approved by nationally recognized testing laboratory.
 2. Provide metal framing members that have a minimum recycled content of 65 percent.
- B. Metal Studs (non-load-bearing type):
1. C-shaped studs and tracks roll-formed from corrosion-resistant galvanized steel that conforms to ASTM-C645.
 2. Galvanized: ASTM-A653, G40.
 3. Stud Depths: As indicated by Wall Types.
 4. Minimum Flanges Width: 1-1/4 IN.
 5. Minimum thickness: 18 mil (25 GA), except as follows:

- a. Provide heavier thickness as required to comply with PERFORMANCE REQUIREMENTS.
 - b. Upgrade framing members to minimum 30 mil (20 GA) studs at following conditions:
 - 1) At jambs of openings: Two 30 mil (20 GA) studs.
 - 2) Where one or both sides of partition will be faced with any of following:
 - a) Tile backing board.
 - b) Adhered stone.
 - c) Plaster.
 - d) Moisture-resistant.
 - e) Abuse-resistant wallboard.
 - f) Lead-backed gypsum wallboard.
 - 3) Where partitions are not extended to overhead structural deck, and are without supporting diagonal bracing, or horizontal stiffeners.
 - c. Provide heavier gauge thickness where specifically indicated.
6. Base Products:
- a. Studs: "Ultrasteel" by Dietrich.
 - b. Tracks (runners): "TR-Series" by Dietrich.
- C. Head-of-Wall Accessories:
- 1. General Criteria:
 - a. Configure to permit deflection of overhead superstructure while maintaining structural integrity, fire and smoke-resistance, and sound control as required by each wall.
 - 2. Basis of Design - Slotted Top Track (a.k.a. deflection Track):
 - a. Deep leg, vertically slotted track for all walls which extend to structure.
 - b. Minimum Thickness: 30 mil (20 GA).
 - c. Width: As required for studs sizes indicated.
 - d. Depth: Minimum 2-1/2 IN down-standing legs with 1/4 IN wide by 1-1/2 IN high slots spaced 1 IN on center.
 - e. Material: Cold-formed sheet steel; galvanized; ASTM-A653, .
 - f. Base Product: "SLP-TRK" by Sliptrack Systems, Dietrick, ClarkWestern, etc.
 - g. Accessories:
 - 1) Include fasteners suitable for attachment to superstructure elements.
 - 2) Include Z-bars, cold-rolled channels, or similar clips to accommodate thickness of Spray-applied Fire-Resistive Materials (SFRM).
 - h. Additional components where walls are fire-rated:
 - 1) Include fasteners, clips and other items necessary to secure wall frame to building superstructure according to UL-listed designs.
 - 2) Select systems tested in accordance with UL-2079 for conditions.
 - i. Firestopping Sealants, Sprays and Forming Materials: Specified in Section 07 84 00.
 - 3. Alternative top track configurations may be considered by Architect for approval.
 - a. Proposed systems must be configured to accommodate deflection of superstructure without inducing axial loading on the partition wall.
 - b. Proposed systems must be tested for fire resistive requirements indicated.
 - c. Contractor is obligated to demonstrate to Architect that proposed system complies with project requirements.
- D. Shaftwall Framing: C-H shaped studs with U or J shaped tracks.
- 1. Material: Galvanized steel complying with ASTM-A653, G40.
 - 2. Minimum Thickness: 40 mil (20 GA).
 - 3. Minimum Size: 2-1/2, 4, and 6 IN as indicated.
 - 4. Stud Spacing: 24 IN.
 - 5. Structural Design Criteria:
 - a. Select stud with properties necessary to limit deflection to L/240 deflection at load of 10 PSF.
 - b. Use larger size and gauge if required to satisfy span and deflection criteria.
 - 6. Shaftwall assembly with gypsum wallboard specified in Section 09 29 00:
 - a. Fire resistance rating: 2 hours in accordance with ASTM-E119.

- b. Sound transmission class: Minimum STC 47 in accordance with ASTM-E90.
 - 7. Base Product: "CT Cavity Shaftwall Studs" by Dietrich.
- E. Z-Bar standoff clips:
 - a. Galvanized steel, minimum 30 mil (20 GA) thickness, 2 IN x 2 IN x 2 IN size by length required, unless otherwise indicated to accommodate beam and deck fireproofing:
 - 2. Provide Z-bars for attachment of top track to superstructure elements which are to be protected with sprayed fireproofing.
 - 3. Length:
 - a. At structural steel member: Length equal to flange width of structural steel member.
 - b. At steel deck: Minimum length equal to partition width, or as required to span steel deck flutes.
 - c. Extend length of Z-bar to accommodate partition offset that will not clear fireproofed steel beam.
 - 4. Base Product: "Z Bar" by Dietrich.
- F. Furring Channels (hat-channels):
 - 1. Hat-shaped sections.
 - 2. Galvanized: ASTM-A653, G40.
 - 3. Sizes: 7/8 and 1-1/2 IN, as indicated.
 - 4. Minimum Thickness: 30 mil (20 GA); Use heavier gauge as dictated by conditions.
 - 5. Base Product: "FC-Series" by Dietrich.
- G. Resilient Channels (RC-channels):
 - 1. Specially designed asymmetrical-shaped channels for improved sound attenuation.
 - a. Items which are approved for use in sound-rated assemblies indicated.
 - b. Where sound walls are also fire-rated: Items must also be approved for use in fire-rated assemblies indicated.
 - 2. Single-leg channel sections, attached perpendicularly to structural parent studs/joists.
 - a. Use double leg variation where used at ceilings with multiple layers of wallboard.
 - 3. Galvanized: ASTM-A653, G40.
 - 4. Sizes: 1-1/4 and 1-1/2 IN, as indicated.
 - 5. Minimum Thickness: 18 mil (25 GA); Use heavier gauge as dictated by conditions.
 - 6. Base Product: "RC-Series" by Dietrich.
- H. Z-Furring:
 - 1. Z-shaped sections, attached to structural parent wall.
 - 2. Galvanized: ASTM-A653, G40.
 - 3. Sizes: 1, 1-1/2, 2, 2-1/2, and 3 IN, as indicated.
 - 4. Minimum Thickness: 18 mil (25 GA); Use heavier gauge as dictated by conditions.
 - 5. XPS Foam Insulation: Specified in Section 07 21 00.
 - 6. Base Product: "ZF-Series" by Dietrich.

2.3 ACCESSORY ITEMS

- A. Wire ties:
 - 1. 43 mil (18 GA) soft annealed, galvanized.
- B. Fasteners for tracks:
 - 1. Power driven type, to withstand minimum 190 LB shear when driven.
- C. Closure:
 - 1. When continuous vapor retarder is required, provide continuous 30 mil (20 GA) galvanized closure angle to receive vapor retarder and vapor retarder tape.
- D. Isolation Strip Material:
 - 1. Non-absorbent, foam padding as required to prevent direct contact between metal framing member and exterior concrete or masonry parent walls.
 - 2. Minimum thickness: 0.40 mil.

- E. Backing (modified track runners):
 - 1. C-shaped track runners; roll-formed from corrosion-resistant galvanized steel that conforming to ASTM-C645.
 - 2. Galvanized: ASTM-A653, G40.
 - 3. Minimum Backing Height: 6 IN.
 - 4. Minimum Flange Width: 1-1/4 IN.
 - 5. Minimum Thickness: 30 mil (20 GA).
 - 6. Base Product: "TR-Series Track Runner" by Dietrich.

2.4 SUPPORT SYSTEMS FOR GYPSUM CEILINGS

- A. Interlocking Grid Systems:
 - 1. Description: ASTM-C645, direct-hung system composed of T-Shaped framing members designed to carry load of screw-applied gypsum ceiling board.
 - 2. Tabs on Cross-Tees to interlock into slots in Main Runners where intersections occur.
 - 3. Base Product: "Drywall Suspension System" by USG Corporation.
 - 4. Optional Products: "Drywall Grid Systems" by Armstrong; "Drywall Furring System" by Chicago Metallic.
 - 5. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.
- B. Track and Channel Systems:
 - 1. Material: ASTM-C645 roll-formed steel with G40 galvanized coating.
 - 2. Minimum Thickness: 30 mil (20 GA); Use heavier gauge as dictated by conditions.
 - 3. Carrying Channels:
 - a. Size: 1-1/2 IN.
 - 4. Furring Channels (hat-channels):
 - a. Sizes: 7/8 and 1-1/2 IN, as indicated.
 - 5. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.
- C. Stud-Framed Ceiling/Soffit Systems:
 - 1. C-shaped studs or joists; roll-formed from corrosion-resistant galvanized steel that conforms to ASTM-C645.
 - 2. Galvanized Coating: ASTM-A653, G40.
 - 3. Minimum Frame Member Depth: 3-5/8 IN minimum, unless otherwise indicated.
 - a. Use wider stud sections if ceiling span and support requires.
 - 4. Minimum flange width: 1-1/4 IN.
 - 5. Minimum stud thickness: 20 gauge.
 - 6. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.
- D. Tie Wire:
 - 1. Material: ASTM-A641, Class 1 zinc coating, soft temper.
 - 2. Minimum Diameter (single-strand): 0.0625 IN (14 GA).
 - 3. Minimum Diameter (single-strand): 0.0475 IN (18 GA).
- E. Wire Hangers:
 - 1. Material: ASTM-A641, Class 1 zinc coating, soft temper.
 - 2. Minimum Diameter: 0.162 IN (8 GA).
- F. Anchors in Concrete:
 - 1. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM-E488 or ASTM-E1512 as applicable.
 - 2. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.

3. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
- G. Power-Actuated Fasteners in Concrete:
1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM-E1190.
 2. Comply with seismic design requirements where applicable.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine supporting structure and conditions under which system will be installed.
- B. Correct conditions detrimental to proper installation.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. General:
1. Installation Standard: ASTM-C754, except comply with framing sizes and spacing indicated.
 - a. Gypsum Board Assemblies: Comply with additional requirements in ASTM-C840 relative to framing installation.
 2. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
 3. Install bracing at terminations in assemblies.
 4. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
 5. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
 6. Extend framing full height to structural supports. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
 - a. Continue framing around ducts and similar items which penetrate partitions.
 7. Utilize slip-type head track assemblies where framing extends to overhead structural supports.
 - a. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
- B. Size floor tracks and head track assemblies to match studs.
1. Align floor track and deflection track accurately.
 2. Secure floor track and deflection track to structure in accordance with manufacturer's instructions and referenced regulatory requirements.
 3. Secure at corners and at ends.
- C. Position studs vertically engaging floor track and head-of-wall deflection track.
1. Space studs maximum 16 IN on center.
 - a. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.
 - b. Positively anchor studs to floor tracks with self-tapping pan head screws, or stud clinching tool on both flanges of each stud.
 - c. Positively anchor studs to deflection track with wafer-head screws on both flanges of each stud.
- D. Fire rated partitions: Anchor as required by fire resistance design, and Firestopping design.

- E. Align stud knockouts to facilitate running of wires and conduit.
- F. Where partitions abut vertical structural elements, provide perimeter relief.
 - 1. Gypsum Association GA-600, Figure 9.
- G. Head-of-Wall:
 - 1. Provide slotted top track for all walls that go to structure.
 - 2. Secure top track to superstructure with 0.145 IN x 1 IN powder actuated fasteners located 16 IN on center (max).
 - a. Pre-fit forming material that may be required as a part of a fire-resistive joint system.
 - 3. Where partitions attach to structural elements that are scheduled to receive Spray-applied Fire Resistive Materials (SFRM):
 - a. Install Z-bar to underside of steel beams and steel deck before sprayed fireproofing is applied.
 - b. Locate Z-bars perpendicular to line of partition, spaced maximum 16 IN on center.
 - c. Attach each Z-bar with two 0.145 IN x 1 IN powder-actuated fasteners located minimum 1 IN from ends of Z-bar.
 - d. After fireproofing, secure top track to Z-bars with No. 8 x 9/16 IN waferhead framing screws spaced maximum 16 IN on center.
 - 4. Where fire-rated partitions are offset and will not clear fireproofed steel beam, extend Z-bar outrigger horizontally from bottom of beam out to minimum 50mm 2 IN beyond width of head-of-wall.
 - a. Attach 3/4 IN expanded metal lath continuous, width of top of Z-bar outriggers prior to fireproofing steel beam to accommodate sprayed fireproofing.
 - 5. Cut vertical studs 5/8 IN short to create a deflection gap when installed into top track.
 - a. Secure vertical studs to top track with No. 8 x 9/16 IN waferhead framing screw at each stud flange, screwing through track slots for positive stud connection.
 - 6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.
 - 7. Prepare wall for installation of seals and/or firestopping:
 - a. Fire-rated Walls: Prepare for fire-resistive joint assemblies specified in Section 07 84 00.
 - b. Non-fire rated partitions (including Smoke Partitions): Prepare for Acoustical Sealant specified in Section 09 29 00.
- H. Furring Channels:
 - 1. Install furring channel systems, directly attached to parent walls, as indicated.
 - 2. Install channels at maximum 16 IN OC.
 - 3. Provide additional framing at openings, cutouts, corners, and control joints.
 - 4. Fasten to masonry walls with cut nails.
 - 5. Fasten to concrete with power driven fasteners.
 - 6. Space fasteners not more than 24 IN OC, staggered on opposite flanges of hat channels.
- I. Remove oil residue from metal studs with detergent before installation of gypsum board or other finish material.

3.3 FRAMING AT OPENINGS

- A. General:
 - 1. Control Joints (CJ): Provide for control joints at all openings.
 - a. Install additional stud, maximum 1/2 IN from jamb studs.
 - b. Do not fasten extra stud to track or jamb stud.
 - c. Refer to specification Section 09 29 00 for control joint locations.
 - 2. Prefabricated headers, jambs, and sill framing systems (optional):
 - a. Proprietary opening framing systems may be considered as an alternative to conventionally fabricated framing.
 - b. Pre-approved Products: "HDS Framing System" by Dietrich.
 - c. Submit propose alternative systems to Architect for review.

- B. Door Openings:
 - 1. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.
 - 3. Jamb Studs:
 - a. Install two studs, toe-to-toe, at each jamb, unless otherwise indicated.
 - b. Minimum thickness of jamb studs: 30 mil (20 GA) at all openings.
 - c. Securely attach jamb studs to door frames.
 - 4. Headers:
 - a. Openings less than 4 FT wide:
 - 1) Cut-to-length section of floor runner above and below wall openings.
 - 2) Split flanges and bend webs at ends.
 - 3) Overlap and screw attach jamb studs to frames.
 - b. Openings over 4 FT wide:
 - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
 - 2) Design for actual span and loading.
 - c. Incorporate Miscellaneous Steel members (Specified in Section 05 50 10) and Wood Blocking (Specified in Section 06 10 53) where indicated.
 - 5. Control Joints at head of Jambs:
 - a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 IN clearance from jamb stud to allow for installation of control joint in finished assembly.
- C. Other Framed Openings:
 - 1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
 - 2. Install framing below sills of openings to match framing required above door heads.
 - 3. Headers and Sills:
 - a. Openings less than 4 FT wide:
 - 1) Cut-to-length section of floor runner above and below wall openings.
 - 2) Split flanges and bend webs at ends.
 - 3) Overlap and screw attach jamb studs to frames.
 - b. Openings over 4 FT wide:
 - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
 - 2) Design for actual span and loading.
 - c. Incorporate Miscellaneous Steel members (Specified in Section 05 50 10) and Wood Blocking (Specified in Section 06 10 53) where indicated.
 - 4. Cripple Studs:
 - a. Install cut-to-length intermediate (vertical) studs above and below openings.
 - b. Spacing: As indicated for typical (full-length) studs.

3.4 WALL BACKING AND BLOCKING

- A. Metal Wall Backing: Provide in-wall metal wall backing reinforcement where following items are required to be wall-mounted to interior walls and interior of exterior walls:
 - 1. Crash rails, chair rails, wall bumpers, and similar wall protection devices.
 - 2. Contractor or ANL-furnished equipment indicated to be wall-mounted.
 - 3. Toilet accessories that do not include proprietary backing devices.
 - 4. Toilet Partitions and Lockers.
 - 5. Markerboards, Tackboards, and Chalkboards.
 - 6. All laboratory walls and laboratory service corridor walls regardless of fixed casework locations.
 - 7. Other wall-mounted items where backing is indicated by details or specification.
- B. Wood Wall Blocking: Specified in Section 06 10 53.
- C. Coordinate mounting height, location, and coverage with item to be supported.

- D. Determine material width according to item to be supported.
- E. Provide in-wall metal wall backing material to interior metal stud walls specified herein and “Exterior” stud walls specified in Section 09 21 27.
- F. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

3.5 INSTALLATION - CEILING

- A. Install in compliance with manufacturer's recommendations.
- B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.
- C. Frame openings in ceiling support system to accommodate access panels and similar openings and penetrations.
 - 1. Completely frame openings with closed channel side of stud facing opening for support of recessed mechanical and electrical items.

3.6 INSTALLING CEILING SUPPORT SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems:
 - 1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
 - 2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances:

1. Install suspension systems that are level to within 1/8 IN in 12 FT measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 29 00
GYPSON WALLBOARD

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Chinese manufactured and imported gypsum wallboard shall not be permitted for use.
- B. ASTM Standards:
 - 1. ASTM-C1396: Standard Specification for Gypsum Board.
 - 2. ASTM-C475: Joint Treatment Materials for Gypsum Wallboard.
 - 3. ASTM-C557: Adhesives.
 - 4. ASTM-D3273: Mold-resistant Gypsum Board.
 - 5. ASTM-C840: Application and Finishing of Gypsum Board.
 - 6. ASTM-C841: Installation of Interior Lathing and Furring.
 - 7. ASTM-C1002: Steel Drill Screws for Application of Gypsum Board or Metal Plaster Bases.
 - 8. ASTM-E84: Surface-Burning Characteristics of Building Materials.
 - 9. ASTM-E90: Sound Transmission Testing.
 - 10. ASTM-E119: Fire Tests of Building Construction.
 - 11. ASTM-C1629: Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
 - 12. GA-216 Recommended Specifications.
 - 13. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.
- C. Environmental Reference Standards:
 - 1. Bay Area Air Quality Management District (BAAQMD):
 - a. Regulation 8, Rule 51.
 - 2. Code of Federal Regulations (CFR):
 - a. 40 CFR, Part 59, Subpart D-2001: National Volatile Organic Compound Emission Standards for Architectural Coatings.
- D. Fire-Resistance-Rated Assemblies:
 - 1. For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM-E119 by an independent testing agency.
 - 2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.
- E. STC-Rated (sound-rated) Assemblies:
 - 1. Provide materials and construction identical to those tested in assembly indicated according to ASTM-E90 and classified according to ASTM-E413 by an independent testing agency.
- F. Environmental Criteria:
 - 1. Insulation: Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines (CPG): Comply with recovered (recycled) content criteria of the CPG for insulation materials.

1.2 SUBMITTALS

- A. Project Information:
 - 1. Manufacturer exposure limitations for wallboard installation prior to building being weather-tight:
 - 2. Manufacturer name of listed products.
- B. LEED Information:

1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer’s product data for construction sealants, including printed statement of VOC content.
4. EQ 4.2, Low-Emitting Materials – Paints and Coatings: Product data indicating VOC content of all paints and coatings.

1.3 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes:
 1. Stack panels flat to prevent sagging.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations:
 1. Comply with ASTM-C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Avoid installation of interior wallboard products until installation areas are enclosed and conditioned.
 1. Temporarily protect un-enclosed spaces from effects of weather.
 2. Do not install panels that are wet, moisture-damaged, or contaminated by mold.
 3. Remove installed items that have been damaged by moisture or are contaminated by mold:
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- C. During gypsum wallboard installation and finishing: Maintain temperatures between 50 and 70 DegF.
- D. Coordinate installation with other trades to allow time for correct installation of their work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 1. Gypsum Wallboard and accessories:
 - a. Base:
 - 1) Georgia Pacific (GP).
 - b. Optional:
 - 1) United States Gypsum (USG).
 - 2) National Gypsum Company (NGC).
 - 3) Certainteed.
 - 4) American Gypsum.
 2. Specialty Drywall Trim:
 - a. Base:
 - 1) Pittcon Industries.

- b. Optional:
 - 1) Fry Reglet Corp.
 - 2) Gordon, Inc.
- 3. Foam tape:
 - a. Base:
 - 1) Norton Performance Plastics.
- 4. Sound Attenuation Batts (SAB):
 - a. Base:
 - 1) Owens Corning.
 - b. Optional:
 - 1) Johns Manville.
 - 2) Knauf Insulation.
 - 3) Guardian.
 - 4) Certainteed.
 - 5) Thermafiber.
- 5. Acoustical sealants:
 - a. Base:
 - 1) USG.
 - b. Optional:
 - 1) Tremco.
 - 2) Pecora.
 - 3) Grabber.
 - 4) BOSS.
 - 5) STI.

2.2 GYPSUM WALLBOARD (GWB) SCHEDULE

- A. General:
 - 1. Utilize the following, in conjunction with Wall Types, Details, and Finish Schedule to determine types of wallboard appropriate to each condition.
 - 2. Furnish in maximum available lengths, consistent with installation requirements:
 - a. Long Edge: Tapered.
 - b. Short Ends: Square.
 - 3. Upgrade the listed types to fire-rated equivalent products when used in fire-rated assemblies.
 - 4. Upgrade the listed GWB products to mold-resistant types, where wallboard is installed in Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations where wallboard is installed prior to building being weather-tight.
- B. Exterior Gypsum Sheathing (walls):
 - 1. Specified in Section 09 21 27.
- C. Exterior Gypsum Sheathing (ceilings and soffits):
 - 1. Specified in Section 09 21 27.
- D. Interior face of Exterior Walls:
 - 1. Mold-resistant (with facer):
 - a. Application: In-board face of exterior stud walls.
 - b. Thickness: 5/8 IN.
 - c. Mold-resistance score: 10 per ASTM-D3273.
 - d. Base Product: "DensArmor PLUS Interior Guard" and "DensArmor PLUS Interior Guard Fireguard" by Georgia Pacific.
 - e. Optional Products:
 - 1) "XP Wallboard" and "Fire-Shield XP Wallboard" by National Gypsum;
 - 2) "Mold Tough" and "Mold Tough Firecode" by USG.
 - 3) "ProRoc Moisture & Mold Resistant Gypsum" and "ProRoc Moisture & Mold Resistant Gypsum Type X" by Certainteed.

- f. Utilize approved fire-resistive products where MR wallboard is scheduled in Fire Rated Walls.
- E. Interior Partitions and Ceilings:
1. Regular board (conventional paper faced , with gypsum core):
 - a. Applications: Non-wet, non-fire rated interior walls and ceilings.
 - b. Thickness: 5/8 IN.
 - c. Base Product: “Toughrock Gypsum Wallboard” by Georgia Pacific.
 2. Fire-rated board (conventional, Type X core, with paper facers):
 - a. Applications: Use for fire rated walls, fire rated ceilings and joint backing at fire rated ceilings.
 - b. Thickness: 5/8 IN.
 - c. Base Product: “Toughrock Fireguard Type X and Toughrock Fireguard C Gypsum Wallboard” by Georgia Pacific.
 - d. Optional Product: “ProRoc Type X” by Certainteed.
 3. Moisture-resistant Gypsum Wallboard (MR GWB):
 - a. Applications: Use for non-tiled walls and casually-wet walls and where indicated. (Upgrade to Tile Backer Board for tiled walls and walls with frequent wetting such as like Showers, Decontam, and Cart Washing etc.).
 - b. Thickness: 5/8 IN.
 - c. Mold-resistance score: 10 per ASTM-D3273.
 - d. Base Product: “DensArmor PLUS Interior Guard” and “DensArmor PLUS Interior Guard Fireguard” by Georgia Pacific.
 - e. Optional Products:
 - 1) “XP Wallboard” and “Fire-Shield XP Wallboard” by National Gypsum;
 - 2) “Mold Tough” and “Mold Tough Firecode” by USG.
 - 3) “ProRoc Moisture & Mold Resistant Gypsum” and “ProRoc Moisture & Mold Resistant Gypsum Type X” by Certainteed.
 - f. “XP Wallboard” “Fire-Shield XP Wallboard” by National Gypsum; “Mold Tough” and “Mold Tough Firecode” by USG.
 - g. Utilize approved fire-resistive products where MR wallboard is scheduled in Fire Rated Walls.
 4. Tile Backer Board (TBB):
 - a. Applications:
 - 1) Provide TBB at walls of showers, tub rooms, toilet rooms, decontamination rooms, and similar walls where tile is scheduled.
 - 2) Provide TBB at non-tile walls that will be continuously wet.
 - b. Description: Moisture-resistant treated gypsum core, glass mats (both sides), and vinyl, water barrier coating on finished side:
 - 1) Conventional cement-board and “green-board” products are not acceptable.
 - c. Thickness: 5/8 IN.
 - d. Base Product: “DensShield Tile Backer” by Georgia Pacific.
 - 1) Include Level 5 finish at non-tiled portions.
 - e. Optional Product (uniform composition):
 - 1) “Fiberock Interior Panel, Aqua-Tough” by USG.
 - 2) “GlasRoc Tile Backer” by Certainteed.
 - f. Where TBB wallboard is scheduled in Fire Rated Walls. Upgrade to approved fire-resistive products with comparable moisture-resistance. Base Product: “DensShield Fireguard Tile Backer” by Georgia Pacific.
 5. Abuse-Resistant Gypsum Wallboard (AR GWB):
 - a. Thickness: 5/8 IN with fire resistant core at rated assemblies.
 - b. Nail pull resistance for 1/2 IN board not less than 120 FT/Lb.
 - c. Screw pull resistance for 1/2 IN board not less than 90 FT/Lb.
 - d. Flexural strength for 1/2 IN board in any direction not less than 110 FT/Lb.
 - e. Upgrade metal studs to 20 GA minimum where used with ARGWB.

- f. Finish as recommended by wallboard manufacturer.
 - g. Applications: Use where specifically indicated “Wall Types”.
 - h. Base Product: “Hi-Impact Brand XP Fire-Shield Wallboard” by National Gypsum.
 - 1) Optional: “Fiberock Brand Panels – VHI Abuse-Resistant” by USG.
- F. Shaftwall Liner Panel (fire-rated):
- 1. Thickness: 1 IN x 24 IN wide.
 - 2. Fire-rated Type X core.
 - 3. Mold and moisture resistant:
 - a. Tested in accordance with ASTM-E136.
 - b. Fiberglass coated glass mats, both faces.
 - c. Base Product: “DensGlass Ultra Shaftliner” by Georgia Pacific.

2.3 TRIM ACCESSORIES

- A. General Interior Trim:
- 1. General:
 - a. Comply with ASTM-C1047.
 - b. Material for general, interior uses: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet
 - c. Material for wet and exterior areas: Zinc.
 - 2. Shapes:
 - a. Corner bead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Corner bead: With notched or flexible flanges.
 - g. Other items as indicated.
- B. Specialty Trim (where specifically indicated):
- 1. General:
 - a. Profiles and dimensions indicated.
 - b. Material: 6063-T5 Aluminum.
 - c. Finish: Factory primed for paint-in-field.
 - d. Flanges to be embedded: Corrosion-resistant primer compatible with joint compound and finish materials specified.
 - 2. Base Products:
 - a. Wall Reveals: “SRW Series” by Pittcon.
 - b. Trim Reveals: “STR Series” by Pittcon.

2.4 JOINT TREATMENT MATERIALS

- A. General:
- 1. Comply with ASTM-C475.
- B. Joint Tape:
- 1. Interior Gypsum Wallboard: Paper.
 - 2. Tile-backing Panels: As recommended by panel manufacturer.
- C. Joint Compounds for Interior Gypsum Wallboard:
- 1. Ensure products are compatible with other compounds applied previously or on successive coats.

Required Compound Types		
Purpose	Additional Description	Compound Type Required
Pre-filling	For filling open joints and voids	Setting-type, Taping Compound
Embedding and First Coat	For embedding tapes & first coat over joints, fasteners, and trim flanges	Setting-type, Taping Compound
Fill Coat	For second coat	Setting-type, Sand-able Topping Compound OR Drying-type, All-purpose Compound.
Finish Coat	For third coat	Drying-type, All-purpose Compound.
Skim Coat	For final coat of Level 5 finish, where a Level 5 finish is specified	Setting-type, Sand-able Topping Compound OR Drying-type, All-purpose Compound. OR High-build, spray-applied coating product designed to produce Level 5 finish (without traditional, trowel-applied skim coat.)

Notes:

1. Above table applies to conventional, paper-faced, interior wallboard. For paperless wallboard panels: Use compounds recommended by panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer. Use compounds recommended by panel manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
4. Glass-Mat, Water-Resistant Backing Panel: Use compounds recommended by panel manufacturer.
5. Provide dust control products in occupied areas or adjacent to occupied areas. Base Product: "Sheetrock Brand Dust Control Joint Compound" by USG.

D. Laminating Adhesive:

1. Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Adhesives applied shall have a VOC content no greater than 50 g/L.

2.5 ACOUSTICAL MATERIALS

A. General:

1. Provide where indicated.
2. Minimum Nominal Thickness: As required to achieve STC indicated for wall systems.
3. Density: As required to achieve STC indicated for wall systems.

B. Sound Attenuation Batts (SAB):

1. Material: Glass or Mineral Fiber.
2. Commercial sound blanket, ASTM-C665, Type I (un-faced) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
3. Surface burning characteristics (per ASTM-E84):
 - a. Minimum Flame Spread: 10.
 - b. Maximum Smoke developed: 10.
4. Fire-Resistance-Rated Assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
5. Acoustically rated Assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
6. Base Product: "Knauf Fiberglass Batt" by Knauf.
7. Optional: Kraft Faced Thermal/Sound Attenuation Blanket" by Guardian.
8. Recycled Content: Provide blankets with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of _____% percent by weight.

- C. Acoustical Sealants:
 - 1. Flexible, non-hardening.
 - 2. Base Product: "Acoustical Sealant" by USG:
 - a. Optional: "Acoustical Sealant" by Tremco; "Dynatrol II" by Pecora; "Acoustical Sealant GSC" by Grabber; "SpecSeal Smoke N Sound Caulk" by STI; "824 Acoustical Sound Sealant" by BOSS.
 - 3. Spray-applied, expanding foam sealants will not be allowed.
 - 4. Acoustical sealants shall have a VOC content no greater than 250 g/L.

2.6 MISCELLANEOUS ITEMS

- A. Firestopping Sealants and Forming Materials:
 - 1. Specified in Section 07 84 00.
- B. Thermal Insulation:
 - 1. Specified in Section 07 21 00 and other Division 07 sections.
- C. Screws:
 - 1. ASTM-C1002, unless otherwise indicated.
 - 2. Self-tapping, bugle head, length to penetrate framing member minimum 5/8 IN.
 - 3. Type S for gypsum wallboard to metal; Type G for gypsum wallboard to gypsum wallboard.
 - 4. Screws used to secure wallboard panels to Metal Studs: Comply with ASTM-C954.
 - 5. Screws used with cementitious backer boards: As recommended by panel manufacturer.
- D. Sealants:
 - 1. Other than acoustical sealant above, see Section 07 92 16.
- E. Foam tape:
 - 1. PVC 1/2 x 1/4 IN: With pressure sensitive adhesive; Norseal.
 - 2. EPDM 1/2 x 1/4 IN: With pressure sensitive adhesive; Cellular rubber by Gasket Dynamics.
- F. Backing for control and expansion joints:
 - 1. Fire rated board.
- G. Sealer for moisture-resistant gypsum wallboard.
 - 1. Manufacturer's standard compound.
 - 2. Use at joints, cut edges and screw penetrations.
 - 3. Sealer shall have a VOC content no greater than 100 g/L.
- H. Framing and suspension systems for Gypsum Board Ceilings:
 - 1. Specified in Section 09 22 16.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

- A. Examine supporting structure and conditions prior to wallboard installation.
- B. Correct unsatisfactory conditions.

3.2 INSTALLATION – GENERAL

- A. General Requirements:
 - 1. Comply with ASTM-C840.
 - 2. Install products per manufacturer's specific installation instructions.
 - 3. Remove loose materials and vacuum cavity of gypsum dust prior to enclosing stud space.
 - 4. Install wallboard vertically with edges over metal stud framing members and similar framing support members.
 - 5. Secure to each support or framing member with screws.

6. Bring boards into contact but do not force into place.
 7. Fit neatly and carefully.
 8. Stagger edge joints on opposite side of partition so they occur on different framing members.
 9. Proceed with attachment from board center toward ends and edges.
 10. Make cuts neatly.
 11. Install with 1/4 IN gap between gypsum board and floor.
 12. Seal ends, cutouts and screw penetrations of moisture resistant boards with sealer.
 13. Install wallboard over metal framing studs and similar framing support members at interior face of exterior walls full height from floor to structure above.
- B. Wallboard installation prior to building being weather-tight:
1. This is intended to allow early installation of wallboard in critical path areas such as: Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations:
 - a. Notify Architect and Laboratory where such early installation is proposed.
 2. Where wallboard is installed prior to building being weathertight: Upgrade the scheduled GWB products to their mold-resistant counterparts:
 - a. Products proposed are subject to Architect approval.
 3. Exposure time shall be limited by manufacturer requirements.
- C. Sound Insulation:
1. Install sound insulation in walls from floor to structure above, where sound rated walls are indicated.
 2. Install in thicknesses and densities necessary to achieve sound rating.
 3. Pack spaces around electric boxes and other penetrations to maintain full sound rating:
 - a. Utilize Acoustical Sealants to fill small voids that remain
- D. Acoustical Sealant:
1. General:
 - a. Apply Acoustical Sealant at joints, voids, and penetrations through wallboard to maximize sound control:
 - 1) Seal wallboard edges to adjacent construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant.
 - 2) Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
 - 3) Comply with ASTM-C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - b. Upgrade to proper firestopping where required in Fire-rated. Refer to Section 07 84 00 for Firestopping of Thru-wall Penetrations.
 2. Base-of-Walls:
 - a. Provide a continuous bead of Acoustical Sealant to bottom edge of Gypsum Wallboard where it meets the floor. Do so at "all" walls regardless of fire rating.
 3. Head-of-Walls:
 - a. Apply Acoustical Sealant to top edge of wallboard where meets the superstructure:
 - 1) Exception: Use Firestopping (Specified in Section 07 84 00) at head condition of "fire-rated walls".
- E. Curved Partitions:
1. Space studs or furring to prevent flat areas between framing at curved surfaces.
- F. Wall Reveals:
1. Install reveal wall channels and/or aluminum framing as recommended by manufacturer.
- G. Changes in Material:
1. Install corner bead where partition or ceiling abuts structural element or dissimilar wall or ceiling.

- H. Installation Wallboard around Metal Door and Window Frames:
1. Contract Documents call for hollow metal frames to be rigorously aligned at time of their original installation:
 - a. Notify frame installer of specific frames that are noticeably out of alignment before wallboard work commences.
 - b. Take care not to unduly disturb their original alignment when installing adjacent wall board.
 - c. Notify frame installer of specific frames that become misaligned during the installation of wallboard.
 2. Upon completion of wallboard work, notify frame installer to return to site and check openings to for proper alignment.
 3. Work with frame installer to correct misalignment issues before proceeding.

3.3 INSTALLATION - SINGLE LAYER SYSTEM

- A. Set screws between 3/8 to 1/2 IN from edges:
1. Space maximum 8 IN OC at edges and, 12 IN OC in field of board.
 2. Where wallboard butts at wall/ceiling juncture, hold screws back 6 IN from edges.
 3. Use closer screw spacing if required by UL.
- B. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.

3.4 INSTALLATION - TWO LAYER SYSTEM

- A. Space screws in base layer maximum 8 IN OC at edges, and 12 IN OC in field of board.
- B. Screw apply finish layer.
- C. Stagger joints not less than one support from first layer.

3.5 INSTALLING TRIM ACCESSORIES

- A. General:
1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints:
1. Install control joints according to ASTM-C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
 2. Bullnose Bead: Use at outside corners.
 3. Bullnose Bead: Use at outside corners where indicated.
 4. LC-Bead: Use at exposed panel edges.
 5. L-Bead: Use where indicated.
 6. U-Bead: Use at exposed panel edges where indicated.
 7. Curved-Edge Cornerbead: Use at curved openings.
- D. Specialty Trim: Install in locations indicated.

3.6 INSTALLATION - SHAFTWALL

- A. Install shaft walls in compliance with UL and Gypsum Association description.
- B. Provide shaft wall systems permitting entire erection procedure from outside shaft.
- C. Provide special metal runner angles and channels, and studs or splines spaced per manufacturers requirements.
- D. Provide number, type and thickness of wallboard layers including air spaces and insulation to achieve indicated ratings for fire resistance and sound reduction.

- E. Comply with requirements for thickness of metal and thickness of wall, for heights of wall indicated.
- F. Use maximum practical board lengths.
- G. Bring boards into contact but do not force into place.
- H. Fit neatly and carefully.
- I. Seal perimeter and openings with firestopping.

3.7 INSTALLATION – CEILING

- A. Install in compliance with manufacturer's recommendations.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install fire rated ceiling assemblies as indicated:
 - 1. Fasten minimum 3 IN wide fire rated board continuous over joints or use firestopping.
- D. Install sound insulation so coverage required for sound rating is achieved; maximum 2.2 PSF.
- E. Access Panels and Doors: Locate where required by Sections 08 31 16 and 26 00 10, or where indicated. See Section 08 31 16 for product description.

3.8 CONTROL JOINTS

- A. General:
 - 1. Install Control Joints in location indicated and as described in this article.
 - 2. Comply with additional requirements of ASTM-C840, GA-216, and GA-234.
 - 3. Install suitable backing material to maintain required rating where Control Joints occur in fire or sound rated assemblies.
- B. Partitions:
 - 1. Provide vertical Control Joints (on both wall faces) which align with door frames, window frames, and similar opening as follows:
 - a. Single Doors and Cased Opening:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - b. Pair doors:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - 2) Exception: Control Joints are not required where partition forms a "cross-corridor" condition.
 - c. Doors with adjacent sidelights:
 - 1) Locate CJ's at both jambs from head of opening to top of partition, and, from sill to floor at sidelight jambs.
 - d. Sliding Doors:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - e. Punched Windows (less than 30 FT in width):
 - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
 - f. Ribbon Windows (more than 30 FT in width):
 - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
 - 2) Locate additional intermediate CJ's (constructed similarly) so that maximum distance between CJ's does not exceed 30 FT apart.
 - 2. Provide additional vertical Control Joints, spaced no more than 30 FT apart from each other, from opening-related CJ's (listed above), or from corners.
 - 3. Provide horizontal Control Joints at partitions which are more than one story in height:
 - a. Locate horizontal Control Joints where partitions bypass each intermediate floor.
 - b. Align control joint with floor line, unless otherwise indicated.

- C. Ceilings:
 - 1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
 - a. Ceilings with perimeter relief:
 - 1) Subdivide so that no area exceeds 2500 FT², and no area has a length which exceeds 50 FT:
 - a) Exception where Ceiling occurs at Exterior: Subdivide so that no area exceeds 900 FT², and no area has a length which exceeds 30 FT.
 - b. Ceilings without perimeter relief:
 - 1) Subdivide so that no area exceeds 900 FT², and no area has a length which exceeds 30 FT.
 - c. Locate Control Joints at transitions between areas of different shapes.
- D. Soffits:
 - 1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
 - a. Exterior Subdivide so that no area exceeds 900 FT², and no area has a length which exceeds 30 FT.
 - b. Locate Control Joints at transitions between areas of different shapes.
 - c. Continue lines of soffit Control Joints vertically to top of fascia.

3.9 WALLBOARD FINISHING

- A. General:
 - 1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
 - 2. Promptly remove residual joint compound from adjacent surfaces.
- B. Pre-fill open joints and voids, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Where wallboard abuts dissimilar surfaces: Securely attach continuous trim beads in accordance with manufacturers directions.
- E. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.
- F. Apply Joint Compound and Tape in accordance with fire-rated design:
 - 1. Apply joint treatment compound in accordance with manufacturer's directions.
 - 2. Fill joints, screw heads, and internal corners with compound.
 - 3. Extend joint system vertically from floor to extent described as follows:
 - a. Fire Walls, Barriers, and Partitions: Extend to full height of wall.
 - b. Smoke Barriers and Partitions: Extend to full height of wall.
 - c. Interior face of exterior wall (non-rated): Extend to full height of wall.
 - 4. Refer to Drawings for indication of partition heights.
- G. Level 4 Finish:
 - 1. Comply with ASTM-C840.
 - 2. After drying, sand or otherwise smooth final coat of compound as needed to eliminate high spots or excess compound to leave smooth, even, and level surface.
 - 3. Draw down final coat of compound to a smooth even plane.
 - 4. Locations:
 - a. Wallboard scheduled to be finished with Gloss Level 1 (flat), Level 2 (velvet), or Level 3 (eggshell) paint, glazed coating, textured coating, or wall covering.
 - b. All other locations, unless noted otherwise.
- H. Level 5 Finish:
 - 1. Comply with ASTM-C840.

2. After irregularities have been eliminated, a thin skim coat of joint compound or material manufactured specifically for this purpose shall be trowel applied to the entire surface of the board and joints, and excess compound removed leaving a thin film covering the surface.
 3. Avoid ridges or tool marks that might show through finishes.
 4. Lightly sand or sponge where required to assure a smooth, even, and level surface.
 5. Locations:
 - a. Exposed ceiling, soffit, or wall areas abutting window mullions, skylights, or receiving direct indoor lighting.
 - b. Long hallways or corridors.
 - c. Atriums, Lobbies, Auditoriums and similar large spaces.
 - d. Multi-story spaces.
 - e. Wallboard scheduled to be finished with Gloss Level 4 (satin), Level 5 (semi-gloss), Level 6 (gloss), Level 7 (high gloss), paint, glazed coating, textured coating, or wall covering.
 - f. Surfaces using MRB or other wallboard types with a glass mat facer on finished side.
 - g. Exceptions: Revert to Level 4 where above listed surfaces are to be finished with textured decorative treatments, wall covering, paneling, or wall guard.
- I. Repairs:
1. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
 2. If wallboard is damaged, or surfaces are roughened, repair, or remove and replace, to satisfaction of Architect, at no additional cost to Laboratory.

3.10 PARTITION IDENTIFICATION

- A. Identify partitions indicated on Drawings as having a required fire or smoke rating.
1. Identification: Same as indicated on drawing legend.
 2. Location: 10 FT on center but not less than once per wall segment, both sides of partition, above ceiling line:
 - a. Above access panels in hard ceiling.
 3. Lettering: 2 IN Helvetica, painted with aid of stencils.
 4. Color: Red.

3.11 PROTECTION

- A. Protect installed wallboard from water damage during construction.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged:
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Prior to finishing, walls shall be inspected for visible mold growth:
1. Replace affected portions.

END OF SECTION

SECTION 09 30 00

TILE

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, movement joints, thresholds, ceramic accessories, and setting methods and details.
- B. Samples:
 - 1. Three full size samples of each tile specified in Room Finish and Color Schedule 09 06 10.
- C. Project Information:
 - 1. Installation methods.
 - 2. Manufacturer's Certificate: For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
- D. Contract Closeout Information:
 - 1. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
 - 2. Letter stating extra material has been delivered.
- E. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer's product data for construction sealants, including printed statement of VOC content.

1.2 QUALITY ASSURANCE

- A. ANSI A137.1, 1988 - Specifications for Ceramic Tile.
- B. TCNA (HB) - Handbook for Ceramic Tile Installation; Tile Council of North America, Inc.
- C. ANSI A108, A118, and A136 Specifications for Installation of Ceramic Tile.
- D. Maintain one copy each of applicable reference standards and specifications on site.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.
- F. Single Source Responsibility:
 - 1. Obtain each type and color of tile from a single source.
 - 2. Obtain each type and color of mortar, adhesive and grout from the same source.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.
- C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
 - 1. Maintain ambient and substrate temperature of 50 DegF during installation of mortar materials.

1.5 EXTRA MATERIALS

- A. Provide 10 sq ft of each size, color, and surface finish of tile specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers:
 - 1. Tile:
 - a. Base:
 - 1) As noted in Room Finish and Color Schedule, 09 06 10.
 - b. Optional:
 - a) Floor tile:
 - (1) CT-1: Virginia Tile – Florim – Layers – Color: Chalk
 - b) Wall Field Tile:
 - (1) CT-2, CT-5 and CT-6:
 - (a) Must contain minimum 20% recycled content verified by Scientific Certification Systems.
 - (b) Must match colors, size, texture and sheen.
 - c) Wall accent tile
 - (1) CT-4:
 - (a) Keope Deco – Fascia Metal #21450 Fas-Metal, 7/8"x18"
 - (b) Virginia Tile – Stainless Steel Series #MT210 1"x8"
 - (2) CT-7:
 - (a) Keope Deco – Profilo Vetro Bianco #15600 Pro Bianco, 3/4"x24"
 - (b) Daltile – GR-13 Frosted 2"x24"
 - (3) CT-8:
 - (a) American Olean- to match and meet same performance criteria, size and sheen.
 - (b) Daltile – to match and meet same performance criteria, size and sheen.
 - (4) CT-9 and CT-10
 - (a) Must contain 40% recycled content
 - (b) Must match color, size, texture and sheen.
 - 2. Accessories:
 - a. Base:

- 1) As noted in Room Finish and Color Schedule, 09 06 10.
- 2) Optional:
 - a) CT-3:
 - (1) Must contain 20% recycled content verified by Scientific Certification Systems.
 - (2) Must match colors, size, texture and sheen.

2.2 TILE

- A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types, colors and pattern indicated on the Drawings and identified in the Schedule. Tile shall also be provided in accordance with the following:
 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
 3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.
 4. Trim Units: Matching bead, bull-nose, cove, inside and outside corners and base shapes in sizes coordinated with field tile.
 5. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
 - a. Level Surfaces: Minimum of 0.6 (Wet).
 - b. Step Treads: Minimum of 0.6 (Wet).
 - c. Ramp Surfaces: Minimum of 0.8 (Wet).
 6. Sizes:
 - a. As noted in Room Finish and Color Schedule, 09 06 10
 - b. Edges: Square.
 7. Grout joint: 3/16 IN or as recommend per manufacturer.

2.3 SETTING MATERIALS

- A. Setting materials: As required by installation Method, See Part 3.
- B. VOC content of adhesives shall have VOC content no greater than 65g/L in accord with SCAQMD Rule #1168.
- C. Tile backer board: See Section 09 29 00.

2.4 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Material and finish, style and dimensions to suit application, for setting using tile mortar or adhesive; use in the following locations:
 1. Transition between floor finishes of different heights.
 2. Thresholds at door openings.

Transition Joint Strips: Profile and height as indicated;

with integral perforated anchoring leg for setting the strip into the setting material:

 1. Transition strip profile:
 - a. Sloped, variable height: If adjacent flooring level is different than tile.
 - 1) Schluter-RENO-V.
 - b. Flat, smooth profile. If adjacent flooring level is same as tile.
 - 1) Schluter-RENO-T.
 2. Height:
 - a. As required to suit application.
 - b. Maximum change in level: 0-1/2 IN.

- c. Maximum slope: 1:2.
- 3. Material: Stainless Steel.
 - a. Finish: As selected by Architect from manufacturer's standard finishes.
- C. Joint Sealant: Two component polyurethane sealant, ASTM-C920, Type M (self-leveling) for horizontal joints, Type II (non-sag) for vertical joints as specified in Section 07 92 16.
 - 1. Color: Match grout.
 - 2. Ensure sealant is chemically compatible with tile, mortar, and grout.
 - 3. Ensure sealant can physically and chemically withstand environmental conditions normally expected at installation areas.
 - 4. Joint Backing: Closed cell foam polyethylene.
 - 5. Sealants shall have a VOC content no more than 70 g/L in accord with SCAQMD Rule #1168.
- D. Expansion and Control Joints for Thin Set Applications: Roll-formed stainless steel profiles joined by a thermoplastic rubber insert, with integral perforated anchoring legs for setting the joint into the setting bed.
 - 1. Height: As required to suit application.
 - 2. Color As selected by Architect.
 - 3. Acceptable Products: Subject to compliance with requirements herein, provide [one of] the following:
 - a. 9/16 IN, metal edge, heavy duty:
 - 1) Schluter-DILEX-KS.
 - b. 3/8 IN, wall or floor :
 - 1) Schluter-DILEX-BWB.
 - c. 3/16 IN, wall or floor:
 - 1) Schluter-DILEX-BWS.
 - d. 3/16 IN, at perimeter of frames or thresholds:
 - 1) Schluter-DILEX-BWA.
 - e. 3/8 IN mortar bed expansion joint:
 - 1) Schluter-DILEX-EP.
- E. Setting Buttons: Plastic buttons of thickness required for joint size indicated to maintain uniform joint width.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.
- B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.
- C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Remove any curing compounds or other contaminates.
- C. Vacuum clean surfaces and damp clean.

- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.
- F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

- A. Install tile and setting materials in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCNA Handbook recommendations.
- B. Exterior: Provide waterproofing method over interior space.
- C. Interior: Provide waterproofing method TCNA "wet" area:
 - 1. "Tile surfaces that are either soaked, saturated, or regularly and frequently subjected to moisture or liquids (usually water), such as gang showers, tub enclosures, showers, laundries, saunas, steam rooms, swimming pools, hot tubs, and exterior areas."
- D. Provide crack isolation membrane method to isolate thin-set tile and stone from minor substrate existing or future cracking.
- E. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than 1/2 width is used. Do not interrupt tile pattern through openings.
- F. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- G. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- H. Form internal angles square and external angles bullnosed.
- I. Install non-ceramic trim in accordance with manufacturer's instructions.
- J. Where accent tiles (such as glass and/or stainless steel tiles) are of a lesser thickness than surrounding field tiles: Increase bedding thickness as required to achieve relatively flush alignment between finished faces of accent tiles and adjacent field tiles.
- K. Install thresholds where indicated.
- L. Sound tile after setting. Replace hollow sounding units.
- M. Allow tile to set for a minimum of 48 hours prior to grouting.
- N. Grout tile joints. Use standard grout unless otherwise indicated, use epoxy grout at floor tile within toilet rooms.
- O. Movement Joints and Other Sealant Usage:
 - 1. Comply with TCNA EJ171.
 - 2. Locate movement joints where indicated.
 - 3. Where not indicated: Locate movement joints directly over the following substrate conditions:
 - a. Changes in substrate material.
 - b. Over control joints, expansion joints and seismic joints in substrate.
 - c. Over construction joints in substrate (cold joints).
 - d. At junctures of floors meet and walls and other restraining elements such as curbs, columns, bases, and wall corners.
 - e. At other locations recommended by TCNA EJ171 Movement Joint requirements.
 - 4. Furthermore, locate additional Movement Joints in accordance with maximum spacing allowed by following table:

Maximum Spacing of Movement Joints	
Condition	Maximum Spacing
Interior	25 FT
Interior where exposed to direct sunlight or moisture.	12 FT
Exterior	

5. Joint Width: In accordance with TCNA EJ171.
 6. Rake or cut control joints through setting bed to supporting slab or structure. Keep joints free of mortar.
 7. Fill joints with self-leveling polyurethane sealant and backing material specified in Section 07 92 16.
 8. Provide sealant material at items penetrating tile work, unless otherwise indicated.
 9. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
 10. Fill joints around toilet fixtures with white silicone sanitary sealant. Refer to Section 07 92 16.
 11. Use manufacturer's expansion joint flashing when covering expansion joints with waterproof or crack isolation membranes.
 12. Provide sealants and related materials in accordance with cited ANSI and TCNA requirements.
- P. Penetrating Sealer:
1. General:
 - a. Apply Penetrating Sealer to all tiled surfaces (unless otherwise noted):
 - 1) Exception: Application of Penetrating Sealer is not necessary where Epoxy Grouts are used.
 - b. Apply in accordance with Manufacturer's instructions.
 2. Surface Preparation:
 - a. Ensure that surface is dry, clean and free of waxes, sealers or finishes.
 - b. Utilize recommended cleaner/stripper as necessary.
 - c. Ensure that tile and grout have been in place and are fully cured (48 - 72 hours depending on conditions).
 - d. Test product in obscure area to ensure desirable results.
 3. Application:
 - a. Apply Penetrating Sealer using a clean new mop, lambswool applicator, sponge or brush.
 - b. Allow it to penetrate for 10 - 15 minutes.
 - c. Wipe off any excess.
 - d. Apply a second coat (using same procedure) to ensure that Grout and porous tiles are well sealed.
 - e. Test after 2 hours by applying drops of water on the surface.
 - 1) If it penetrates immediately, apply an additional coat.
 4. Cleaning:
 - a. If a residue is visible on the surface after drying, remove it with a sponge or white polishing pad 60 minutes after application.

3.4 CLEANING

- A. Clean tile and grout surfaces.

3.5 PROTECTION OF FINISHED WORK

- A. Do not permit traffic over finished floor surface for 72 hours after installation.
- B. Cover floors with kraft paper and protect from dirt and residue from other trades.

- C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways.

3.6 INSTALLATION METHODS

INSTALLATION - FLOORS - THIN-SET METHODS			
Application/Substrate	TCNA	Bond/mortar	Grout
Exterior Concrete	F102	Dry set or latex Portland cement	Standard grout
Exterior Concrete/waterproof (above interior space)	F102	Waterproof membrane/ Dry set or latex Portland cement	Standard grout
Interior concrete	F113	Dry set or latex Portland cement	Standard grout
Interior concrete/waterproof (wet areas)	F122	Waterproof membrane/ Latex-Portland cement	Polymer modified
Interior epoxy	F131	Epoxy	Epoxy
INSTALLATION - WALL TILE			
Application/Substrate	TCNA	Bond/mortar	Grout
Backer /membrane (toilets)	W245/247	Latex-Portland cement	Standard/polymer modified
Backer	W223	Organic	Standard/polymer modified
Concrete or masonry	W202	Dry set or latex Portland cement	Standard/polymer modified
Interior epoxy	W245, W247, W244 E,C,F	Latex-Portland cement	Epoxy
Glass Tile/ Stainless Steel Tile	Coordinate with tile manufacturer. As recommended by tile manufacturer.	Coordinate with tile manufacturer. As recommended by tile manufacturer.	Coordinate with tile manufacturer. As recommended by tile manufacturer.

END OF SECTION

SECTION 09 30 41
STONE MATRIX STAIR TREADS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Stone Matrix Stair Treads, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Physical property test standards:
 - 1. Abrasive hardness: ASTM-C501.
 - 2. Absorbtion of water: ASTM-C373.
 - 3. Bond Strength: ASTM-C482.
 - 4. Break Strength: ASTM-C648.
 - 5. Dimensional measurements:
 - a. Thickness and width ASTM-C499.
 - b. Warpages: ASTM-C485.
 - c. Wedging: ASTM-C502.
 - 6. Frost Resistance: ASTM-C1026.
- B. Installation Standards:
 - 1. Tile Council of America (TCA) Ceramic Tile Institute Handbook for Ceramic Tile Installation.
 - 2. American National Standards Institute (ANSI) Specifications for the Installation of Ceramic Tile.

1.3 SUBMITTALS

- A. Samples:
 - 1. 12 x 12 IN sample for review of selected color, pattern, and texture.
- B. Shop Drawings:
 - 1. Indicate layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, movement joints, thresholds, ceramic accessories, and setting methods and details.
 - 2. Manufacturer's Certificate: For each shipment, type and composition of stair tread provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
- D. Contract Closeout Information:
 - 1. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
 - 2. Letter stating extra material has been delivered.
- E. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer’s product data for construction sealants, including printed statement of VOC content.

1.4 JOB CONDITIONS

- A. Complete installation before application of other items that might be damaged by this work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Stone matrix units:
 1. Base:
 - a. As noted in Room Finish and Color Schedule, 09 06 10.
 2. Optional:
 - a. Alternate manufacturer’s must meet the following performance criteria:
 - 1) Recycled glass chips to be 100% Post-Consumer recycled content.
 - 2) Manufactured within 500 mile radius of project location.

2.2 MATERIALS

- A. Stone Matrix Units:
 1. Recycled glass set in epoxy binder, fabricated to form and stair treads complying as follows:
 - a. Stair Treads: Form and dimensions indicated in drawings, 1/2 IN thick.
 - b. Abrasive Hardness: Minimum 35 wear index.
 - c. Absorbtion of water: Maximum of 0.5 percent.
 - d. Bond Strength: Minimum 50 PSI.
 - e. Break Strength: Minimum of 250 PSI.
 - f. Dimensional Measurements: Maximum deviations of 0.05 IN in thickness, 4 percent in width, 1 percent along any edge in warpage, and 1 percent in wedging.
 - g. Frost Resistance: No crazing or spalling.
 - h. Slip Resistance: Minimum 0.60.
 - i. Color and Pattern: Specified in Section 09 06 10.
 - j. Finish: 220 grit finish, price alternate option at 600 grit finish.
- B. Setting and joint treatment materials:
 1. Latex-commercial or dryset portland cement grout: ANSI-A118.6.
 2. Expansion joints strips:
 - a. Rigid polyvinylchloride.
 - b. Thickness 1/4 IN unless indicated otherwise.
 - c. Color: Match grout color.
 3. Sealant: One or two component, non-sag, polyurethane or silicone; complying with Section 07 92 16.
 - a. Sealant VOC content shall be no greater than 250 g/L.

2.3 EXTRA MATERIAL

- A. Extra Tile:
 1. Upon completion of work, deliver extra tile of same size, pattern and color used on job to Laboratory.
 2. Provide one full stair tread.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrates and conditions under which stair treads are to be installed.
- B. Correct unsatisfactory conditions.
- C. Starting installation constitutes acceptance of surface and responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Tile Setting:
 - 1. Place tile in grid pattern.
 - 2. Align tile joints on adjoining walls.
 - 3. Lay out and center tile fields in both directions in each space or on each wall area.
 - 4. Avoid use of tile less than 1/2 size.
 - 5. Adjust tile to minimize cutting.
 - 6. Provide uniform 1/8 IN joint widths insofar as practicable.
- B. Expansion Joints
 - 1. Install expansion joints as indicated.
 - 2. Place joints 24 to 36 FT OC or on column lines each way, whichever is less.
 - 3. Apply over construction or expansion joints in backing.
 - 4. Apply where backing material changes.
 - 5. Apply where floors abut vertical surface.
- C. Maintain nominal 1/4 IN wide joint at perimeter of tiled floor areas and caulk with sealant.
- D. Remove mortar waste immediately.

3.3 INSTALLATION - THINSET

- A. Provide leveling beds as required for thinset installation to finished elevation indicated.
- B. Install in accordance with ANSI-A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
 - 1. TCA method F-113.
 - 2. Install grout in accordance with ANSI-A108.10.

3.4 PROTECTION

- A. Assure temperature is maintained at minimum 50 degF and for minimum 7 days after completion of installation.
- B. Protect installed tile work with kraft paper or other non-staining covering during construction to prevent damage.
- C. Protect floors, subject to traffic, with plywood over kraft paper.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL & CEILING TILE MATERIALS (AM)

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Standard for suspension systems: ASTM-C635.
- B. Standard for installation: ASTM-C636.
- C. Ceilings and Interior Systems Construction Association (CISCA):
 - 1. Seismic Zones as 0 through 2.

1.2 DESIGN PARAMETERS

- A. Suspension System Design Parameters:
 - 1. Comply with:
 - a. 2003 International Building Code (Section 1621) and 2002 ASCE-7 (Section 9.6.2.6).
 - b. CISCA Standards: Current latest edition unless other editions are specifically by above building code or ASCE-7.
 - 2. IBC Seismic Category: Category B.

1.3 SUBMITTALS

- A. Samples:
 - 1. Three samples of each material selected for verification.
 - B. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Letter stating extra material has been delivered.
 - 3. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
- C. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants, including printed statement of VOC content.

1.4 JOB CONDITIONS

- A. Carefully coordinate ceiling layout with other work that penetrates acoustical ceiling systems.
- B. Specifically coordinate with sprinkler head spacing.

- C. Install acoustical material after floor and wall finishes.

PART 2 - PRODUCTS

2.1 MATERIALS - ACOUSTICAL SUSPENSION SYSTEMS

- A. Suspension systems - General:
 - 1. Heavy duty systems, ASTM-C635.
 - 2. Main runner jointing by spliced, interlocking ends, tab locks, pin locks, or other suitable connections.
 - 3. Cross runners interlocking with main runners.
 - 4. Provide types indicated.
- B. Acceptable manufacturers (Suspension Systems):
 - 1. Steel Suspension Systems:
 - a. Base:
 - 1) As noted for individual types in Room Finish and Color Schedule 09 06 10.
 - b. Optional:
 - 1) USG.
 - 2) Chicago Metallic.
- C. Hanger Wire:
 - 1. General:
 - a. Pre-stretched, with a yield stress load of at least 5 times design load, but not less than 0.080 IN (12 GA).
 - b. Utilize continuous lengths, without kinks and splices.
 - 2. Galvanized Steel (general use):
 - a. Galvanized, soft annealed steel wire, conforming to ASTM-A641.
- D. Trim: Provide moldings wherever ceiling meets walls, partitions, other vertical elements, and other types of ceilings or ceiling fixtures; where ceiling mounted fixtures have integral flange trim, no additional trim is required.
- E. Attachment Devices:
 - 1. Size for 5 times the design load indicated in ASTM-C635, Table 1, "Direct Hung," unless otherwise indicated:
 - a. Comply with seismic design requirements where applicable.
 - 2. Anchors in Concrete:
 - a. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM-E488 or ASTM-E1512 as applicable.
 - b. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
 - c. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3. Power-Actuated Fasteners in Concrete:
 - a. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM-E1190.
- F. Suspension systems - types:
 - 1. **CG-1:** Exposed grid, non-rated:
 - a. Description: Galvanized, double web steel, main and cross runners.
 - b. Face width: 9/16 IN.
 - c. Base Product:

- 1) "Suprafine XL", by Armstrong
 - d. Optional:
 - 1) Chicago Metallic
 - 2) USG
 - e. Finish on exposed surfaces: Smooth, flat white.
 - 2. **CG-15: 15/16 IN Gasketed Grid; Non-rated:**
 - a. Base Product:
 - 1) "15/16 IN Co-Extruded Clean Room Grid System" by Armstrong World Industries.
 - b. Optional Product:
 - 1) "BarrierGrid Standard 15/16 Exposed Gasketed" by Chicago Metallic Corporation.
 - c. Structural Classification of System: ASTM-C635 Intermediate Duty.
 - d. Face Width: 15/16 IN.
 - e. Height Width: 1-1/2 IN.
 - f. Provide main and cross tees, gasketed perimeter channels or angles, connectors, splice connectors and hold down clips for a complete installation.
 - g. Gasket:
 - h. Factory-applied.
 - 1) Fungus resistance test method 508.1 mill-std 810C.
 - 2) Flame resistance test FMYSS 302 with burn rate of 4 IN per minute.
 - 3) USDA approval standards.
- G. Framing and suspension systems for Gypsum Board Ceilings:
1. Specified in Section 09 22 16.

2.2 MATERIALS - CEILING TILES

- A. Acceptable manufacturers (Ceiling Tiles):
1. Ceiling tile - Wet formed mineral fiber:
 - a. Base:
 - 1) As noted for individual types in Room Finish and Color Schedule, 09 06 10.
 - b. Optional:
 - 1) USG.
 - 2) CertainTeed.
 - c. General performance description:
 - 1) Scheduled finishes to be factory applied.
 - 2) Light reflectance: Not less than 0.90.
 - 3) Noise reduction coefficient: 0.70.
 - 4) Class A incombustible units. Flame Spread Index 25 or less. Smoke development: 50 or less.
 - 5) Fire rated units (when used): UL labeled.
 - 6) Minimum 65% pre-consumer and 15-17% post-consumer recycled content.
 - 7) No added formaldehyde – free of formaldehyde-based resins.
 - 8) Edges uniformly fabricated, true, square.
 - 9) Sizes as required to fit scheduled suspension system.
 - 10) Tile to inhibit surface growth of mold and mildew.
 - 11) Tile to be manufactured within 500 miles of project.
 - 12) Lay-in style: Minimum 1/2 IN thick.
 - 13) Standard tile size(s): See Reflected Ceiling Plan(s).
- B. Acoustical Material Products:
1. As noted in Room Finish and Color Schedule, 09 06 10.
 2. Ceiling tile - Mineral fiber, wet-formed, mylar-faced:
 - a. Base:
 - 1) As noted for individual types in Room Finish and Color Schedule, Section 09 06 10.

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- b. Optional manufacturers must meet general description/performance:
 - 1) Mineral fiber wet-formed, mylar-faced, membrane; factory installed.
 - 2) Non perforated.
 - 3) Light reflectance: Not less than 0.79.
 - 4) Acoustics: CAC – not less than 40.
 - 5) Class A combustible units.
 - 6) Edges uniformly fabricated, true, square.
 - 7) Sizes as required to fit scheduled suspension system.
 - 8) Lay-in style: Minimum 5/8 IN thick.
 - 9) Standard tile size(s): See Reflected Ceiling Plan(s).
 - 10) Minimum percentage of recycled content: 38%
 - 11) Manufactured within 500 miles of project location.

2.3 EXTRA MATERIAL

AD-4: Section 09 51 00: Revised paragraph 2.3.A.

- A. Provide 5% of each type and pattern of material for maintenance purposes.
- B. Provide in sealed labeled boxes to facilitate identification.

2.4 RELATED MATERIALS (SPECIFIED ELSEWHERE)

- A. Diffusers and grilles: Specified in Section 23 31 13.
- B. Light Fixtures: Specified in Section 26 51 13.
- C. Sealants specified in Section 07 92 16.
 - 1. Sealants applied in this section shall have a VOC content of no greater than 250 g/L.

2.5 FABRICATION

- A. Intersections between Main Tees and Cross Tees: Butt cut and notch as required.
- B. Perimeter Wall Angles: Fabricate to match the system(s) specified.
- C. Include components and accessories necessary resist seismic loads and dead loads of items such as light fixtures and air diffusers.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Examine installation site for unevenness or irregularities that would affect quality and execution of work.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Consult other trades involved before start of ceiling work, to determine areas of potential interference.
- B. Do not start installation until interferences have been resolved.

3.3 INSTALLATION TOLERANCES

- A. Comply with ASTM-C635.
- B. Maximum deviation from level plane: Not to exceed 1/8 IN in 10 FT (with no load applied).

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- C. Maximum Bow: Not to exceed 1/32 IN in 2 FT.
 - D. Maximum Camber: Not to exceed 1/32 IN in 2 FT.
 - E. Maximum Twist: Not to exceed 1 Degree in 2 FT.

3.4 INSTALLATION - SUSPENSION SYSTEM - GENERAL

- A. Design and install ceiling system per Cisca standards indicated in Part 1.
- B. Install suspension system in accordance with ASTM-C636 and manufacturers' instructions.
- C. Grid layout: See Reflected Ceiling Plans:
 - 1. Install grid square with room and with grid center lines or acoustical panel center lines coinciding with center lines of room, each direction:
 - a. Acoustical panel dimension at perimeter walls: Not less than 6 IN.
 - b. In case of conflict with lighting plan contact Architect.
- D. Do not use defective or damaged materials.
- E. Install moldings where ceilings meet walls, partitions, other vertical elements, and other types of ceilings:
 - 1. Support runners and border units on moldings.
 - 2. Secure moldings to wall construction by fastening through holes drilled in web.
 - 3. Space holes not more than 3 IN from each end and at each stud.
 - 4. Draw up fasteners tight against vertical surfaces.
 - 5. Miter cut inside and outside corners.
 - 6. Level to a tolerance not more than 1 in 1000.
 - 7. Install with leg supporting bottom flange of runners.
- F. Leave suspension system ready to accept installation of acoustic materials.

3.5 INSTALLATION – WALL ANGLES

- A. Install Wall Angles where ceilings meet walls, partitions, other vertical elements, and other types of ceilings:
 - 1. Secure Wall Angles to wall construction (coincident with stud spacing):
 - a. Maximum spacing from terminal ends: 3 IN.
 - b. Draw up fasteners tight against vertical surfaces.
 - 2. Level to a tolerance not more than 1 in 1000.
 - 3. Miter cut inside and outside corners.
 - 4. Install with leg supporting bottom flange of Main Tee's and Cross Tees.

3.6 INSTALLATION – HANGER WIRES

- A. General:
 - 1. Provide in time to avoid delay in progress of work.
 - 2. Provide hangers and inserts necessary to support ceiling suspension systems and ceiling dead loads.
 - 3. Locate and align hangers and inserts correctly.
 - 4. Coordinate location and alignment with work of other trades.
 - 5. Do not suspend any part of suspension system from ducts, pipes, conduit, equipment, cable tray, etc.
 - 6. Provide supplementary rough suspension system and trapeezing where necessary to support ceilings beneath pipes, ducts, equipment, etc.
 - 7. Install hanger wires plumb to main tees and cross tees.
 - 8. Splay hangers no greater than 30 degrees from vertical to avoid obstructions or other conditions that prevent plumb, vertical installation.
 - 9. Install wires vertically in such a manner that they are not more than 1:6 out-of-plumb, unless counter-sloping wires are provided.

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10. Do not attach wires to, bent around, interfering material or equipment.
- B. Space hangers to prevent loads from items in or on ceiling from causing eccentric deflection and rotation:
 1. Provide additional hangers to support lighting fixtures.
 2. Provide additional hangers within 6 IN of end of main runners.
 3. Do not bear runners on walls or partitions.

3.7 INSTALLATION – MAIN RUNNERS

- A. Utilize Wall Angles to align and receive terminal ends of Main Tees without transferring load to Wall Angle.
- B. Space Main Tees as indicated, and as required to receive lay-in panels and fixtures.
- C. Support terminal ends of Main Tees by wires located within 6 IN from boundary walls.
- D. Suspend Main Tees from building superstructure with hanger wires specified.
- E. Support Main Tees with hanger wire at intervals necessary to support applied load and to satisfy deflection criteria.

3.8 INSTALLATION – CROSS RUNNERS

- A. Space Cross Tees as indicated, and as required to receive lay-in panels and fixtures:
 1. Install cross runners with a positive interlock.
- B. Utilize Wall Angles to align and receive terminal ends of Cross Tees without transferring load to Wall Angle.
- C. Support terminal ends of Cross Tees by wires located within 6 IN from boundary walls.
- D. Suspend Main Tees from building superstructure with hanger wires specified.
- E. Support Main Tees with hanger wire at intervals necessary to support applied load and to satisfy deflection criteria.

3.9 INSTALLATION – LAY-IN ITEMS

- A. Install acoustic materials into suspension system in accordance with manufacturer's instructions.
- B. Install lay-in panels, fixtures, diffusers, grilles, and similar items in a manner that will not compromise performance of the suspension system:
 1. Provide supplemental hangers for fixtures which exceed manufacturer's published load data.
 - a. Supplemental hanger systems shall be approved by Building Official.
- C. Field cut as required to fit materials to grid:
 1. Tegular and similar tiles articulated edges:
 - a. Machine field-cut edges to match profile of factory edges.
- D. Make cuts square and true.
- E. Do not install damaged units.
- F. Identify access tile with a white headed thumb tack.
- G. Hold-down Clips:
 1. Provide Hold-down-clips where mylar-faced and/or foil-faced tiles are scheduled.
 2. Provide Hold-down-clips where scrubable tiles are scheduled.
 3. Provide hold down clips if UL rated ceiling requires.

3.10 CLEANING

- A. Perform cleaning and replacement of defective units in time to avoid delay in progress of work and before final completion of work.
- B. Carefully clean soiled surfaces.
- C. Remove and replace irregular, discolored, defective or damaged components at no additional expense to Laboratory.

3.11 PROTECTION

- A. Protect installed materials from damage.

END OF SECTION

SECTION 09 54 27
WOOD CEILING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Wood Ceiling System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Maintain the quality as indicated and in accordance with AWI.
- B. Design Criteria: Manufacture and install true and plumb to within manufacturing tolerance of 1/8 IN over 8 FT long.
- C. Product Construction:
 - 1. Wood: Kiln dried to 10%.
 - 2. Cracking, checking and warpage is unacceptable.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's data.
 - B. Shop Drawings:
 - 1. Show areas involved, attachment conditions and perimeter circumstances.
 - C. Samples:
 - 1. Three wood samples showing wood type, finish and stain.
 - D. Contract Closeout Information:
 - 1. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- E. LEED Information:
 - 1. MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 & 5.2 –Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. MR 7, Certified Wood: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood obtained from forests certified by an FSC-accredited certification agency 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.
4. EQ 4.4, Low-Emitting Materials, Composite Wood & Agrifiber Products: For composite-wood and agrifiber products used, documentation indicating that the bonding agent contains no urea formaldehyde. For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.

1.4 WARRANTY

- A. Warrant all materials for a period of one (1) year against manufacturing defects.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Wood ceiling system:
 1. Base:
 - a. As noted in Room Finish and Color Schedule, 09 06 10.
 2. Optional manufacturers must meet the following performance characteristics:
 - a. Total recycled content: 92%
 - b. Acoustics NRC: .50
 - c. Fire rating: Class A
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Wood ceiling system:
 1. As noted in Room Finish and Color Schedule, Section 09 06 10.
 2. FSC certified.
 3. Manufactured without urea formaldehyde resins.
- B. Product Configuration:
 1. As detailed by manufacturer.
 2. Install planks in E-W direction.
- C. Panels shall have a veneer edge.
- D. Attachment System: Suspended according to manufacturers suggested method of suspension. Comply with Seismic Zone 2-4 regulations as required.
- E. Fire Rating: Class 1(A) Fire Rating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Measure ceiling areas and establish layout for hangers and carriers, in accordance with installation instructions.

END OF SECTION

SECTION 09 60 05

WATER VAPOR EMISSION CONTROL FOR CONCRETE WITH APPLIED FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Delaminating, blistering, staining, mold growth, and other problems related to installation and performance of moisture-sensitive flooring materials on concrete slabs are possible.
 - 1. Chemistry of flooring and installation products, concrete installation, and weather conditions during construction period are some factors contributing to possible problems.
 - 2. Moisture resistant adhesives and moisture mitigation systems may be applied to concrete surface to produce moisture state allowing flooring to bond to concrete surface.
 - 3. Tests are not long term predictors of moisture conditions. They only indicate conditions at time of test, but can be useful benchmarks if conditions do change.
 - 4. For most meaningful results, it is imperative tests are executed under environment conditions required by testing standards.
 - 5. Objective of this section is to reduce potential for moisture related problems in slabs-on-grade and suspended slabs.
 - 6. This specification requires a pre-determined level of resistance to help neutralize future problems.
 - 7. In the rare case that testing exceeds minimum design criteria indicated, each individual condition will need further evaluation.

1.2 DESCRIPTION

- A. Test concrete floors, on grade or suspended, before finish flooring installed; to determine moisture, humidity, and alkalinity conditions. See Section 01 45 23.
 - 1. Provide additional testing required by flooring manufacturers.
 - 2. Test data may serve as benchmark for future testing.
 - 3. Test data may discover problematic areas that may need remediation prior to proceeding.
- B. Provide flooring manufacturer's recommended vapor resistive products on concrete floors, on grade or suspended, to resist current and future excessive moisture, humidity, and alkalinity conditions and; reduce mold, mildew, and micro-organism growth:
 - 1. Adhesive applied and fluid-applied flooring:
 - a. Resist humidity levels of at least 80%, ASTM-F2170.
 - b. Resist pH levels of at least 9, ASTM-F710.
 - c. Contractor option: Provide flooring manufacturer's recommended water vapor emission control system, compatible with flooring installation.
 - d. Floors testing above proposed system's maximum level of effectiveness; bring to attention of Architect.
 - e. Provide as dictated by testing.
- C. Provide materials of this section in areas to receive applied flooring products:
 - 1. See Room Finish Schedule.
- D. If different systems are used on differing adjacent flooring areas, verify compatibility of systems.
 - 1. One system that satisfies criteria for all flooring types may be used.

1.3 QUALITY ASSURANCE

- A. References:
 - 1. ASTM-F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

2. ACI-302.2R: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

B. Installation Contractor:

1. Firm with not less than 5 years of successful flooring experience similar to work of this section and flooring systems specified; and accepted by flooring manufacturer, including:
 - a. Testing procedures.
 - b. Moisture resistive adhesives.
 - c. Moisture mitigation systems.
2. Upon request, submit letter from flooring manufacturer stating acceptance.

1.4 PRE-INSTALLATION MEETING

- A. Pre-installation meeting, directed by Contractor, prior to beginning of flooring work to discuss following:
1. Contract Document requirements.
 2. Floor plan.
 3. Flooring manufacturer's recommendations and details.
 4. Leveling compound manufacturer's recommendations.
 5. Adhesive manufacturer's recommendations.
 6. Moisture resistant adhesive manufacturer's recommendations.
 7. Moisture mitigation system manufacturer's recommendations.
 8. UL requirements.
 9. Available on site storage.
 10. Floor protection from damage by other trades.
- B. Attendance is recommended for:
1. Contractor.
 2. Flooring installer's superintendent.
 3. Flooring manufacturer's representative.
 4. Concrete installer.
 5. Other trades whose work may affect flooring system.
- C. Minimum two weeks prior to meeting, flooring installers shall forward pertinent information to Contractor for review.
1. Installation drawings.
 2. Manufacturer product data.
 3. Samples of proposed materials.
 4. Sample warranty.
 5. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.
- E. Objectives of pre-installation meeting to include:
1. Review foreseeable methods and procedures related to flooring work.
 2. Tour representative areas of flooring substrates (decks); inspect and discuss condition of substrate, joints, drains, curbs, penetrations and other preparatory work performed by others.
 3. Review normal-weight and light-weight concrete locations.
 4. Review metal deck, vented or non-vented.
 5. Review water/cement ratios.
 6. Review curing process.
 7. Review under-slab vapor barrier and soil conditions.
 8. Review deck for loss of flatness/levelness.
 9. Review leveling compound.
 10. Review weather history from time of concrete pour to until meeting.
 11. Review mechanical system requirements for testing and flooring installation.
 12. Review testing and installation temperature and humidity requirements.
 13. Review flooring system requirements, (drawings, specifications and other contract documents).
 14. Review required submittals both completed and yet to be completed.

15. Review and finalize construction schedule related to flooring work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 16. Review conditions at adjacent flooring types.
 17. Review required inspection, testing, certifying and material usage accounting procedures.
 18. Record discussion of meeting including decisions and agreements (or disagreements) reached.
 - a. If substantial disagreements exist at conclusion of meeting, determine how disagreements will be resolved and set date for reconvening conference.
- F. Furnish copy of record to each party who may be affected by flooring work, whether or not they were in attendance, and to Laboratory and Architect.

1.5 SUBMITTALS

- A. Project Information:
 1. Test reports:
 - a. Each flooring area of each flooring type.
 2. Manufacturer and product for each flooring type.
- B. LEED Information:
 1. Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 WATER VAPOR EMISSION CONTROL

- A. Acceptable manufacturers:
 1. Water vapor resistive adhesive, or water vapor emission control system:
 - a. Base:
 - 1) Flooring manufacturer's approved products.
- B. Products capable of meeting design criteria:
 1. Compatible floor covering, mitigation system, adhesive, and leveling system products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate and conditions under which flooring is to be installed.
- B. Verify substrates are clean, free from moisture, or materials that may affect adhesion.
- C. Verify concrete cured a minimum of 28 days.
- D. Verify concrete surfaces are free of defects and irregularities.
- E. Verify concrete type and water/cement ratio, see Section 03 31 00.
- F. Verify installation of under-slab retarder, see Section 03 31 10.
- G. Verify curing procedure used, see Section 03 31 10.
- H. Verify floors are level or meet indicated slope, see Section 03 35 00.
- I. Do not proceed with installation until unsatisfactory conditions have been corrected.

- J. Installation indicates acceptance of substrates and responsibility for performance.
- K. Verify flooring manufacturer's installation criteria for each type of flooring.

3.2 TESTING

- A. Test concrete for each area of each flooring type as required by flooring manufacturer.
- B. Conditioning: Minimum 48 hours prior to testing:
 - 1. Concrete floor slabs: Service temperature.
 - 2. Occupied air space above the floor slab: Service temperature.
 - 3. Occupied air space relative humidity above the floor slab: Service humidity.
 - 4. Continue conditioning required until, during, floor installation.
 - 5. Continue conditioning after flooring installation as required by applicable manufacturers.
 - 6. See Construction Schedules.
 - 7. See Temporary Heating, Ventilation, and Cooling, Section 01 50 00.
 - 8. Tests:
 - a. Alkalinity: ASTM-F710.
 - b. Humidity within concrete: ASTM-F2170.
 - c. Other tests as required by flooring manufacturer.

3.3 PREPARATION

- A. Moisture Resistant Adhesive: As recommended by flooring and adhesive manufacturers.
- B. Emission control system: As recommended by mitigation system manufacturer.
 - 1. Mask and protect walls, equipment from installation process.
 - 2. Shot blast or grind concrete surfaces, grind near walls and clean joints.
 - 3. Broom-sweep and vacuum slab surfaces to remove dust and debris.

3.4 INSTALLATION

- A. Install system components with manufacturer employed or approved personnel.
- B. Apply control system as recommended by manufacturer.
 - 1. Fill cracks, joints, and surface irregularities as recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Allow materials to acclimate for a minimum of 72 hours at a temperature of 70 DegF and relative humidity of 50%.
- B. Protect floor.

END OF SECTION

SECTION 09 65 13
RESILIENT BASE (RB)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Resilient Base (RB), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Reference Standard: ASTM-F1861.
 - 1. Thermoplastic Rubber: Type TS (thermoset vulcanized rubber) per ASTM-F1861, PVC free.
- B. Critical Radiant Flux, per ASTM-E648 / NFPA 253:
 - 1. Class I, not less than 0.45 W/cm².
- C. Smoke Developed: 450 or less per ASTM-E662 / NFPA 258.
- D. ASTM-E84 flame spread: Maximum, 75; smoke developed: Maximum, 250.

1.3 SUBMITTALS

- A. Samples:
 - 1. Resilient Base:
 - a. 3 samples of material and color selected for verification.
 - b. Field-fabricated corners: Construct sample base inside and outside corner:
 - 1) Include minimum 4 FT straight base each direction from corner.
 - 2) If not acceptable construct additional corners.
 - a) Stress whitening and cracking will not be acceptable.
 - b) Color and height variation will not be acceptable.
 - 3) Sample corners constitute standard of quality for actual construction.
 - 4) Maintain sample corners during construction.
 - 5) Remove when directed.
 - 6) Sample corners may be built into permanent construction provided sample area is readily identifiable during construction.
 - 7) Do not proceed with base installation until sample corners are approved by Architect.
- B. Contract closeout information:
 - 1. Warranty.
 - 2. Maintenance data.
 - 3. Letter stating extra material has been delivered.
 - 4. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- C. LEED Information:

1. MR 4.1 and 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating amount of post-consumer and post-industrial recycled content.
2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesive and seam sealer, including printed statement of VOC content.

1.4 WARRANTY

- A. Remove and replace defective areas to satisfaction of Architect at no additional expense to Laboratory.
- B. Written warranty that material will be free from manufacturing defects for one (1) year from date of purchase.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Resilient base (RB):
 1. Base:
 - 1) As noted in Room Finish and Color Schedule, 09 06 10.
 2. Optional manufacturers must meet the following performance criteria:
 - a. PVC free with ability to be recycled at end of life.
 - b. Contain 10% natural rubber and meet CHPS criteria
 - c. 100% type TS rubber.
 - d. Comply with buy American.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Resilient base (RB):
 1. Rubber top set, coved type.
 2. 1/8 x 4 IN, 1/4 IN wide at bottom.
 3. Field formed external and internal corners.
 4. Provide continuous rolls, minimum 95 FT long.
 5. Thickness tolerance: Complies with ASTM F-386
 6. Flexibility: Complies with ASTM F-137
 7. Resistance to Heat Aging: Complies with ASTM F-1515
 8. Resistance to Detergents: Complies with ASTM F-925
 9. Resistance to Alkalis: No fading or softening
 10. Dimensional Stability: Complies with ASTM F-1861
 11. Squareness: 90 degrees +/- 0.5 degrees
 12. Does not contain any of the hazardous chemicals listed in California Proposition 65
 13. Collaborative for High Performance Schools (CHPS) 01350 Low-Emitting Material Criteria: Pass
 14. Complies with ASTM F-1861 Type TS
- B. Resilient Base (RB) at carpet:
 1. Rubber top set, straight type.
 2. 1/8 x 4 IN.
 3. Field formed external and internal corners.
 4. Provide continuous rolls, minimum 95 FT long.
 5. Thickness tolerance: Complies with ASTM F-386

6. Complies with ASTM F-137
 7. Resistance to Heat Aging: Complies with ASTM F-1515
 8. Resistance to Detergents: Complies with ASTM F-925
 9. Resistance to Alkalis: No fading or softening
 10. Dimensional Stability: Complies with ASTM F-1861
 11. Squareness: 90 degrees +/- 0.5 degrees
 12. Does not contain any of the hazardous chemicals listed in California Proposition 65
 13. Collaborative for High Performance Schools (CHPS) 01350 Low-Emitting Material Criteria: Pass
 14. Complies with ASTM F-1861 Type TS
- C. Leveling compound: As recommended by manufacturer, compatible with adhesives.
- D. Adhesives and primers:
1. As recommended by manufacturer with a VOC content no greater than 50 g/L.

2.3 EXTRA MATERIAL

- A. 20 LF of each color and type of base for maintenance.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that substrates are clean, free from moisture, or materials which may affect adhesion.
- B. Carefully examine surfaces for defects and irregularities.
- C. Installation constitutes acceptance of surfaces.

3.2 PREPARATION

- A. Fill cracks, joints, etc., with water resistant non-crumbling patching compound.
- B. Trowel to smooth and proper level.

3.3 INSTALLATION

- A. Do not start work until work of other trades has been completed.
- B. Install after wall finishes.
- C. Install prior to carpet and acoustical material.
- D. Maintain work spaces at 65-85 degF with maximum 75 percent humidity 72 hours prior, during, and after installation.
- E. Protect adjacent work from damage.
- F. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- G. Install base after wall material has dried out thoroughly.
 1. Provide base at intersections of floor and vertical surfaces in areas scheduled to receive base, where intersection is exposed to view.
 2. Apply primer and adhesive as recommended by manufacturer.
 3. Set base straight and true.
 4. Fit base neatly into breaks and recesses.
 5. Install corners as recommended by manufacturer.
 6. Scribe to trim at doors and door frames.
 7. Make joints tight.
 8. Install with top and bottom edges in firm contact with wall and floor.

- H. Air out construction with 100 percent outside air.
 - 1. Do not recirculate prior to occupancy.
 - 2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.

3.4 CLEANING

- A. Immediately after application and rolling remove surplus adhesive.
- B. When materials have sufficiently seated, clean in accordance with manufacturer's recommendations.
- C. Leave smooth and clean.

END OF SECTION

SECTION 09 65 19
RESILIENT TILE FLOORING (RT)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Resilient Tile Flooring (RT), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM:
 - 1. ASTM-F1700, "Standard Specification for Solid Vinyl Tile.
 - 2. ASTM-D2047: "Measuring Static Coefficient of Friction of Flooring Finishes".

1.3 SUBMITTALS

- A. Samples:
 - 1. Resilient Tile: 3 samples of each material and colors in Room Finish and Color Schedule, Section 09 06 10 for verification.
- B. Project Information:
 - 1. Manufacturer's data stating that adhesives comply with applicable VOC regulations.
- C. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Letter stating extra material has been delivered.
 - 3. Warranty.
 - 4. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- D. LEED Information:
 - 1. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesive and seam sealer, including printed statement of VOC content.
 - 2. EQ 4.3, Low-Emitting Materials – Flooring Systems: Manufacturer's Product data indicating that flooring products comply with the following standards:
 - a. Manufacturers' product data that resilient floor tile and base adhesives comply with the VOC requirements of EQ Credit 4.1.
 - b. Manufacturers' product data that resilient floor tile is certified as compliant with the Scientific Certification System FloorScore standard.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold.

1. Protect adhesives from freezing.
 2. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- C. Store at minimum 70 DegF for 72 hours before installation.

1.5 JOB CONDITIONS

- A. Maintain site installation conditions in the following range: 65 to 85 DegF with maximum 75% relative humidity for at least 48 hours before, during, and for not less than 48 hours after installation.
1. Thereafter, maintain a minimum temperature of 55 DegF in areas where work is completed.
 2. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.
 3. Provide artificial heating or cooling as required.
 4. Verify equipment will not leave contaminants on concrete.
- B. Install flooring and accessories after the other finishing operations, including painting, have been completed.
1. Close spaces to traffic during the installation of the flooring.
 2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.
- C. Install flooring after wall finishes.
- D. Install tile flooring prior to carpet and acoustical ceiling material.
- E. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- F. Air out construction with 100% outside air.
1. Do not recirculate prior to occupancy.
 2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.

1.6 WARRANTY

- A. Remove and replace defective areas to satisfaction of Architect at no additional expense to Owner.
- B. Written warranty that material will be free from manufacturing defects:
1. From date of purchase: Material, 5 years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Resilient Tile (RT):
1. Base:
 - a. As noted for individual type in Room Finish and Color Schedule, Section 09 06 10.
 2. Optional manufacturer's must meet the following criteria:
 - a. Must produce same shapes, sizes and colorways as product specified.
 - b. Must meet all the same performance criteria as product specified.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 RESILIENT TILE PRODUCTS

- A. Luxury Vinyl Tile (RT):
1. Description: Clear, unfilled, polyurethane-coated, 0.020 IN thick PVC wear layer over a printed film on an intermediate layer over a filled vinyl backing.

2. ASTM-F1700 Class III, Type B – Embossed Surface.
3. Critical Radiant Flux, per ASTM-E648 / NFPA 253: Class I, not less than 0.45 W/cm².
4. Smoke Developed: 450 or less per ASTM-E662 / NFPA 258.
5. Minimum Static Load Limit: 750 PSI.
6. Nominal Total Thickness: 0.100 IN gauge.
7. Nominal Size(s):
 - a. Circle: 11-3/4 IN DIA
 - b. Diamond: 12 IN, tip to tip.
8. Base Product: As noted in Room Finish and Color Schedule, Section 09 06 10.

2.3 RELILIENT STAIR TREAD PRODUCTS

- A. Resilient Stair Treads (RST):
 1. Base:
 - a. As noted in Room Finish and Color Schedule, Section 09 06 10.
 - b. Color: As noted in Room Finish and Color Schedule, Section 09 06 10.
 2. Static coefficient of friction: 0.6.
 3. 2 - 3/4 IN abrasive strips near nose.
 - a. Abrasive strip color(s):
 - 1) Typical treads: Black.
 - b. Adhesive and stair caulk as recommended by manufacturer.
 4. Critical Radiant Flux, per ASTM-E648 / NFPA 253:
 - a. Class I, not less than 0.45 W/cm².

2.4 MISCELLANEOUS PRODUCTS

- A. Leveling Compound:
 1. As recommended by manufacturer:
 - a. Compatible with adhesives.
 - b. Moisture resistant.
 - c. Non-crumbling.
- B. Primers and Adhesive (general-use):
 1. As recommended by flooring manufacturer.
 2. Not to exceed 50 g/L in accord with SCAQMD regulations.
- C. Transition Strip:
 1. Nominal Size: 1/8 x 1 IN plain color homogeneous vinyl with backing.
 2. Use tapered profiles where abutting material is of different thickness.
- D. Water Vapor Emission Control System: See Section 09 60 05.

2.5 EXTRA MATERIAL

- A. General:
 1. Provide materials in clearly labeled containers.
- B. Quantities of Extra Material Required:
 1. Resilient Tiles: One full carton of each type, color and pattern of material for maintenance.
 2. Stair Treads: 2 extra stair treads.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which flooring is to be installed.
 1. Verify that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

2. Verify surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
 3. Verify substrates are clean, free from moisture, or materials which may affect adhesion.
 4. Verify floors are level or meet indicated slope.
- B. Report conditions contrary to contract requirements that would prevent a proper installation.
1. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- C. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor.
1. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

- A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects as recommended by the flooring manufacturer.
- B. Remove paint, varnish, oils, release agents, sealers, and waxes.
1. Remove residual adhesives as recommended by the flooring manufacturer.
 2. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring.
 3. Avoid organic solvents.
- C. Verify concrete floor surfaces are suitable for Resilient Tile Flooring installation.
1. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
 2. Verify limits of moisture and alkalinity are within levels tolerated by Resilient Tile Flooring manufacturer and setting materials manufacturer.
- D. Determine compatibility by a bond test or by the adhesive/flooring manufacturer's recommendations.
- E. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.
- F. Protect adjacent work from damage.
- G. Fill cracks, joints, holes, depressions etc., in floors with leveling compound.
1. Provide level surface or meet indicated slope.
- H. Where resilient flooring abuts other finish flooring materials and finished surfaces do not align, feather leveling compound for approximately 12 IN so finished surfaces will align.
- I. Coordinate leveling with water vapor emission control system specified in Section 09 60 05.

3.3 INSTALLATION - GENERAL

- A. Do not start until work of other trades is complete.
1. Coordinate with other floor, wall and ceiling work.
- B. Apply primers and adhesives as recommended by manufacturer.

3.4 INSTALLATION – FLOORING

- A. Install flooring in accordance with manufacturer's recommendations.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc.
1. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

- C. If required, install flooring on pan-type floor access covers.
 - 1. Maintain continuity of color and pattern within pieces of flooring installed on these covers.
 - 2. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions.
 - 1. Observe the recommended adhesive trowel notching, open times, and working times.
- F. Lay in patterns selected by Architect.
 - 1. All directional tile shall be installed in the same direction, east and west.
 - 2. Bond tile to floor, flush, tight, and in true alignment with adjacent tiles and with finished surface.
 - 3. Fit neatly into breaks and recesses, against walls, around pipes, and other obstructions.
 - 4. Install tapered edge Transition Strips where tile edge is exposed or where flooring terminates.
 - 5. Lay out tile to avoid less than 1/2 tile at permanent walls.
 - 6. Perform cutting or drilling of tile as required.
- G. Where tile color changes or floor finish material changes to sheet vinyl or sheet rubber:
 - 1. Install accenting Transition Strips.
 - 2. Where seam occurs in door openings: Locate Transition Strip directly under door when in closed position.
 - 3. Where abutting materials are Carpet, Ceramic Tile, Quarry Tile, Stone Tile etc: Utilize the Transition Strip specified in respective section.
- H. Roll entire floor.

3.5 INSTALLATION – STAIR TREADS

- A. Install stair treads in adhesive recommended by tread manufacturer.
 - 1. Roll to assure adhesion.

3.6 ADJUST AND CLEAN

- A. Immediately after application and rolling, remove surplus adhesive.
- B. Damp mop entire floor.
- C. Clean floors in accordance with manufacturer's recommendations.
- D. Leave floors smooth and clean.
- E. Protect with non-staining building paper as may be necessary to prevent dirt and damage.
- F. Protect traffic areas with fiberboard or plywood.
- G. Prohibit traffic on floors for 24 hours after installation.
- H. Prior to final walk through:
 - 1. After thorough cleaning, apply two coats of wax recommended by flooring manufacturer.
 - 2. Buff after each coat.

END OF SECTION

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SECTION 09 65 20
RUBBER FLOOR TILES (RFT)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Rubber Floor Tiles (RFT), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Minimum Physical Properties:

Minimum Physical Properties		
Property	Test Method	Required Value
Abrasion Resistance (min)	ASTM-D3389	0.500 Grams/1000 cycles \leq 0.4
Minimum Hardness Shore A	ASTM-D2240	75
Coefficient of Friction (James Method)	ASTM-D2047	\geq 0.5
Static Load Limit (min)	ASTM-F970	\leq 0.005" Residual Compression at 800 lbs
Flammability	NFPA 253	Class I
Smoke Density	NFPA 258	NBS smoke density < 450

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Showing transition details.
 - B. Samples:
 - 1. Full sized specimens.
 - C. Contract Closeout Information:
 - 1. Warranty.
 - 2. Maintenance Data.
 - 3. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- D. LEED Information:
 - 1. MR 4.1 and 4.2: Manufacturers' product data for products with recycled content indicating amount of post-consumer and post-industrial recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. LEED Credit EQ 4.1: Manufacturers' product data indicating that adhesives comply with South Coast Air Quality Management District, Rule 1168.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Tiles: Maintain stored tiles in a clean and dry, protected environment.
- B. Adhesive: Store above 50 DegF in a dry, heated space.

1.5 WARRANTY

- A. 1-year warranty against manufacturing defects in material and workmanship.
- B. 5-year limited wear warranty.

1.6 EXTRA MATERIALS

- A. Furnish full size units of each tile type and color equal to 2 percent of the quantity of resilient flooring installed as extra material. Properly label and package extra material. Deliver to Owner's designated storage area.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Rubber Floor Tiles (RFT):
 1. Base:
 - a. Nora Systems, Inc.
 2. Optional:
 - a. To Market
 - b. Ceres.
 - c. Dodge-Regupol.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIAL

- A. Rubber Floor Tiles (RFT):
 1. Base Product: "noraplan environcare" by Nora Systems
 2. Description: Rubber Flooring Tile.
 3. Composition: nora rubber compound 913 with environmentally compatible color pigments.
 4. Tile Thickness: 0.12 IN. (2463)
 5. Size:
 - a. 610mm by 610mm, 24 IN by 24 IN.
 6. Color:
 - a. As indicated in Color Schedule, Section 09 06 10.
 7. Flammability:
 - a. Class 1
 8. PVC Free
- B. Adhesive:
 1. Single-component polyurethane with VOC content no greater than 50 g/L, in accord with SCAQMD Rule 1168 for VOC content.
- C. Miscellaneous Materials:
 1. Include compatible Transition/Reducer Strips as required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate and conditions under which flooring is to be installed.
- B. Verify substrates are clean, free from moisture, or materials which may affect adhesion.
- C. Carefully examine surfaces for defects and irregularities.
- D. Verify floors are level or meet indicated slope.
- E. Inspect substrate for markers, paint and similar materials used for layout by others, and take remedial action as necessary to remove layout line work to prevent bleed-through.
- F. Do not proceed with installation until unsatisfactory conditions have been corrected.
- G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

- A. Verify concrete floor surfaces are suitable for Rubber Floor Tile installation.
 - 1. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
 - 2. Verify limits of moisture and alkalinity are within levels tolerated by Rubber Floor Tile manufacturer and setting materials manufacturer.
- B. General:
 - 1. Fill cracks, joints, holes, depressions etc., in floors with leveling compound.
 - a. Provide level surface or meet indicated slope.
 - 2. Where resilient flooring abuts other finish flooring materials and finished surfaces do not align, feather leveling compound for approximately 24 IN so finished surfaces will align.
- C. Maintain appropriate room temperature 48 hours before, during and 72 hours after installation of tiles.
 - 1. Temperature and humidity range: 68° F (20° C), ± 5°F (3°C) and 50% RH ± 10%.
- D. Allow ample time for tiles to equalize to ambient temperature.

3.3 INSTALLATION -GENERAL

- A. Layout as indicated on Drawings.
- B. If not indicated, center in rooms as follows:
 - 1. Establish a starting course by finding the mid-point on all four walls.
 - 2. Use a chalk line and mark the two center lines across the whole area.
 - 3. Use the perpendicular chalk line as starting point to lay out the tiles.

3.4 INSTALLATION – SQUARE-EDGED TILES (GLUE-DOWN)

- A. Pattern:
 - 1. Install in running bond, in color pattern indicated.
- B. Install resilient flooring in accordance with manufacturer's installation guides.
 - 1. Do not mix manufacturing batches of a color within the same area.
 - 2. Do not install resilient flooring over building expansion joints.
 - 3. Do not install defective or damaged resilient flooring.
 - 4. Layout resilient flooring to provide equal size at perimeter. Adjust layout as necessary to reduce the amount of resilient flooring which is cut to less than half full width.
 - 5. Lay resilient flooring with arrows in the same direction (excluding borders).
 - 6. Install resilient flooring without voids at seams. Lay seams together without stress.
 - 7. Cut/scribe resilient flooring neatly at perimeter and obstructions.
 - 8. Extend resilient flooring into reveals, closets, and similar openings.

9. Remove excess adhesive immediately.
 10. Install reducer strips at exposed edges.
- C. Do not allow adhesive to build up between seams or be spilled on the surface of the tiles.
1. Do not tape seams.
- D. Roll each row when finished and roll total floor when completed.
1. Roll floor in both directions.
 2. Avoid traffic on newly installed tiles.
 3. NO foot traffic of any kind should be allowed on tiles for 72 hours.
 4. Roll with device and weight recommended by maker of tiles to ensure that the underside mat surface is fully bonded to the glue and sub-floor.
 5. Avoid over-rolling.
- E. Do not allow misapplied adhesive to cure on the flooring.
1. Immediately wipe off excess adhesive using a damp cloth dampened with mineral spirits (use sparingly and only on the adhesive itself).

3.5 REPAIR

- A. Protect installed work from damage by others.
- B. Repair damaged units prior to final approval.

3.6 CLEANING

- A. Immediately after application and rolling, remove surplus adhesive.
- B. Damp mop entire floor.
- C. Clean floors in accordance with manufacturer's recommendations.
- D. Leave floors smooth and clean.
- E. Protect with non-staining building paper as may be necessary to prevent dirt and damage.
- F. Protect traffic areas with fiberboard or plywood.

END OF SECTION

SECTION 09 65 35
STATIC DISSIPATIVE RESILIENT SHEET FLOORING (SDRS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Static Dissipative Resilient Sheet Flooring (SDRS), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Sheet Material: Per ASTM-F1913 / ASTM-F1303:
 - a. Type II, Grade 1, Class B.
- B. Static Load Limit: 800 PSI per ASTM-F970.
- C. Electrical Resistance: ASTM-F150
 - 1. 1,000,000 to 1,000,000,000 ohm.
- D. Static coefficient of friction: 0.5 minimum per ASTM-D2047.
 - 1. 0.8 minimum where used on ramps.
- E. Applicator must be approved in writing by materials manufacturer.

1.3 SUBMITTALS

- A. Project Data:
 - 1. Manufacturer's standard product data indicating compliance with specifications.
 - 2. Certification of installer qualifications.
 - 3. Test results.
- B. Shop Drawings:
 - 1. Seaming Diagram.
 - 2. Samples:
 - a. Three 9IN x 12IN samples of each color specified in Room Finish and Color Schedule, 09 06 10.
- C. Contract closeout information:
 - 1. Maintenance data.
 - 2. Warranty.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating amount of post-consumer and post-industrial recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. LEED Credit EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesive and seam sealer, including printed statement of VOC content.

1.4 WARRANTY

- A. Warrant that sheet flooring will meet electrical resistance requirements for five (5) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Static Dissipative Resilient Sheet Flooring (SDRS):
 - 1. Base:
 - a. As noted in Room Finish and Color Schedule, Section 09 06 10.
 - 2. Alternate:
 - a. Nora Rubber
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Static Dissipative Resilient Flooring (SDRF):
 - 1. Homogeneous vinyl, with pure carbon backing.
 - 2. Wear layer Thickness: 2.0 mm 0.80 IN.
 - 3. Width: 2m 6 FT – 6 IN.
 - 4. Length: 25m 82 FT- 7 IN.
 - 5. Backing: ASTM-F1303, Class B.
 - 6. Conductivity: NFPA-99, ASTM-F150, and UL-779, for minimum of 5 years after acceptance.
- B. Adhesive: Type recommended by manufacturer.
 - 1. Adhesive VOC content no greater than 60 g/L in accord with SCAQMD Rule #1168.
- C. Welding Rod: Vinyl. 4mm 0.18 IN. Color to match sheet vinyl.
- D. Leveling compound: As recommended by flooring manufacturer with characteristics which obtain required electrical conductance factors for completed floor.
- E. Copper strips: Weight and size recommended by manufacturer of flooring.
- F. Transition strips:
 - 1. 1 IN wide matching flooring thickness.
 - 2. Tapered profiles where necessary match abutting materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which flooring is to be installed.
- B. Verify concrete floor surfaces are suitable for Static Dissipative Resilient Sheet Flooring installation.
 - 1. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
 - 2. Verify limits of moisture and alkalinity are within levels tolerated by Static Dissipative Resilient Sheet Flooring manufacturer and setting materials manufacturer.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.
- D. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

- A. Remove incompatible residual materials such as curing compounds, paint, varnish, oils, release agents, sealers, waxes and other incompatible materials, using means approved by manufacturer.
 - 1. Determine compatibility by a bond test or by the adhesive/flooring manufacturer's recommendations.
 - 2. Avoid organic solvents.

- B. Maintain work spaces at 70-85 degF for 72 hours prior to installation, during, and after installation.
 - 1. Provide heating or cooling as required.
 - 2. Verify equipment will not leave contaminants on concrete.
- C. Install after wall finishes.
- D. Install prior to carpet and acoustical material.
- E. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- F. Ventilate construction with 100 percent outside air.
 - 1. Do not recirculate prior to occupancy.
 - 2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.
- G. Fill low spots, holes, cracks and level subfloor with leveling compound.
- H. Remove foreign matter that would prevent adhesion.
- I. Remove curing compounds.
- J. Sand all concrete substrates with No.3 sandpaper.
- K. Remove projecting irregularities by chipping or grinding smooth.
- L. Grind off high spots.
- M. Rinse subfloor and allow to dry thoroughly before apply adhesive.

3.3 INSTALLATION

- A. Lay continuous copper strip parallel to walls.
- B. Provide leads to allow attachment to ground.
- C. Install flooring and base as scheduled for rooms under and behind casework and equipment.
- D. Install per manufacturer's instructions.
- E. Install in maximum possible sizes.
 - 1. Apply adhesive per manufacturer's recommendations.
 - 2. Install 7/8 IN coved fillets behind integral bases.
 - 3. Provide plastic cap strip at top of base.
 - 4. Install tapered edge Transition Strips where tile edge is exposed or where flooring terminates.
- F. Where color changes or floor finish material changes:
 - 1. Install accenting Transition Strips.
 - 2. Where seam occurs in door openings: Locate Transition Strip directly under door when in closed position.
 - 3. Where abutting materials are Carpet, Ceramic Tile, Quarry Tile, Stone Tile etc: Utilize the Transition Strip specified in respective section.
- G. Install with accurate, tight seams.
- H. Reverse alternate sheets.
- I. All sheets in one room or area from same production run.
- J. Weld seams using conductive vinyl welding rod.
- K. Remove excess rod and buff to match adjacent surfaces.

3.4 CLEAN

- A. When final building cleanup is being accomplished, clean flooring by mopping with detergent and water.
- B. Rinse with clean water.
- C. Apply no soap, wax, polish or other coating on conductive sheet floors.
- D. Buff floor and base.
- E. Remove damaged flooring, and flooring not passing resistance test, and replace with new flooring at no additional expense to Owner.

3.5 FIELD TEST

- A. Perform resistance testing of completed floor per the following:
 - 1. Field tests shall be performed by manufacturer's representative in accordance with ASTM-F150.
 - 2. Perform one test for each 2500 SF of floor, but not less than one test for each room.
- B. Average resistance for protection against shock, arc or spark shall be between 1,000,000 and 1,000,000,000 ohm.
- C. Correct areas that fail to comply with electrical resistance requirements, including replacement of flooring if necessary.
 - 1. Retest flooring until electrical resistance requirements comply.

END OF SECTION

SECTION 09 66 23
THIN-SET EPOXY TERRAZZO (TERR)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Thin-Set Epoxy Terrazzo, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with recommendations of National Terrazzo and Mosaic Association, (NTMA).

Minimum Physical Properties		
Property	Test Method	Required Value
Hardness, @ 24 hours Shore D	ASTM-D2240	85/65
Compressive Strength	ASTM-D695	10,000 PSI
Tensile Elongation	ASTM-D638	2 - 4%
Tensile Strength	ASTM-C307	2500 PSI
	ASTM-D638	6000 PSI
Water Absorption	ASTM-D570	0.10%
Adhesion	ACI-503R	350 PSI, 100% concrete failure
Abrasion Resistance	ASTM-D4060, CS-17 Wheel	70-90 milligrams lost
Flammability	ASTM-D635	Self-extinguishing over concrete
Flexural Strength	ASTM-C580	4500 PSI
	ASTM-D790	10,000 PSI
Impact Resistance	MIL-D-3134, Sec. 4.7.3	16 FT-LBS w/out cracking, delamination or chipping
Resistance to Elevated Temperatures	MIL-D-3134J	No slip or flow at required temperature of 158°F
Slip Resistance	ADA Standards	Complies

- B. Employ only an installer who is experienced and skilled in use of material and approved by manufacturer.
- C. Obtain materials same source manufacturer.
- D. Contractor's Qualifications:
 - 1. Installation must be performed by a manufacturer-certified applicator with skilled mechanics having not less than 3 years satisfactory experience in the installation of the type of system as specified in this section
 - 2. Installer certified in writing by the manufacturer of the Thin-set Epoxy Terrazzo Flooring System.
 - 3. Must be current contractor member in good standing with the National Terrazzo Mosaic Association (NTMA).

1.3 SUBMITTALS

- A. Shop drawings:
 - 1. Joint treatments, and edge conditions, and elevations and layout.
 - a. Include details of anchorage and special features.

- b. Grounding details for conductive installations.
- B. Samples:
 - 1. 6 x 6 IN square samples of each type, pattern and color of terrazzo for review of color, pattern and texture only.
 - 2. Resubmit until approved.
- C. Project information:
 - 1. Written certification of compliance with NTMA requirements.
 - 2. Manufacturer's installation instructions and certificate indicating that materials are in compliance with specifications.
 - 3. Manufacturer's written approval of installer.
- D. Contract closeout information:
 - 1. Manufacturer's instructions for maintenance.
 - 2. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- E. LEED Information:
 - 1. MR 4.1 & 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating amount of post-consumer and post-industrial recycled content.
 - 2. MR 5.1 & 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.2, Low-Emitting Materials, Paints and Coatings: Manufacturers' product data for paints and coatings including printed statement of VOC content.

1.4 JOB CONDITIONS

- A. Visit the jobsite prior to the installation of the Thin-set Epoxy Terrazzo Flooring System to evaluate substrate condition, including substrate moisture transmission, quantity and severity of cracking, and the extent of repairs needed.
 - 1. Substrate imperfections should be repaired only after mechanical preparation of the substrate.
 - 2. Surface preparation reveals most imperfections requiring repair.
 - 3. Concrete substrates shall be tested to verify that the moisture vapor transmission of the substrate does not exceed the Thin-set Epoxy Terrazzo Flooring System manufacturers' recommendations.
- B. Exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, as well as in-place equipment.
 - 1. Prepare the substrate to remove laitance and open the surface.
 - 2. This shall be achieved by light brush grit blasting.
 - 3. Surface profile achieved shall be similar to medium grit sandpaper and free from bond-inhibiting contaminants.
- C. Complete installation before application of adjacent materials which are subject to be damage by terrazzo installation.
- D. The minimum slab temperature must be conditioned to 60 DegF before commencing installation, during installation, and for at least 72 hours after installation is complete.
 - 1. The substrate temperature must be at least 5 DegF above the dew point during installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Synthetic matrix terrazzo (TERR):
 - 1. Base: As noted in Room Finish and Color Schedule, Section 09 06 10. See aggregate mix Part 2.2 C.
- B. Optional:
 - 1. Sherwin Williams; General Polymers.
 - 2. Crossfield Products; Dex-O-TEX.
 - 3. Tec, H.B. Fuller.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Synthetic matrix terrazzo flooring system (TERR):
 - 1. Factory-mixed, thermosetting, epoxy resin and hardener, mineral filler and pigment, 100% non-volatile, complying with or exceeding NTMA requirements and as herein specified.
 - 2. Finished Terrazzo Thickness (nominal):
 - a. 3/8 IN. Base Product: "Thin-Set Epoxy Terrazzo #1100 Series" by General Polymers.
 - 4. Optional:
 - a. "Thin-Set Epoxy Terrazzo #1100 Series" by General Polymers.
 - b. "Dex-O-TEX Cheminert Terrazzo" by Crossfield Products.
 - c. "Tuff-Lite Epoxy # 205" by Tec, HB Fuller.
- B. Binder Resin:
 - 1. Base Product: "3520 Epoxy Terrazzo Matrix" by General Polymers.
 - 2. Color: TBD.
- C. Aggregate:
 - 1. Recycled colored glass chips (100% post-consumer recycled glass)
 - a. 30% clear plate glass (green tint)
 - 1) Equal percentage of chip sizes 0, 1 and 2.
 - b. 60% crystal glass
 - 1) Equal percentage of chip sizes 0, 1 and 2.
 - 2. Mother of pearl chips
 - a. 10% mother of pearl
 - 1) Chip size 3.
 - 3. Color and grading to match Architect's approved sample.
- D. Crack and Joint Filler: Epoxy base.
 - 1. Base Manufacturer: General Polymers.
- E. Crack Isolation Membrane: High solids flexible epoxy membrane.
 - 1. Base Product: "3556 Epo-Flex Terrazzo Membrane" by General Polymers.
- F. Finishing grout / Filler:
 - 1. Compound with filler and pigments, as recommended by matrix manufacturer.
 - 2. Base Product: "5270 Epoxy Filler" by General Polymers.
- G. Finish sealer:
 - 1. Compound furnished or approved by matrix manufacturer.
 - 2. Base Product: "4540 Acrylic Polyurethane Floor Sealer" by General Polymers.
 - 3. Sealer VOC content shall be no greater than 100 g/L.
- H. Divider strips:
 - 1. Style: As required for type and thickness of terrazzo.
 - 2. Material and Thickness:
 - a. For non-conductive terrazzo:

- 1) Material: White alloy zinc or aluminum.
- 2) Size:
 - a) 14 GA X depth matching the thickness of terrazzo.
- I. Accessory strips:
 - 1. Provide Cove Base Beads, Cove Divider Strips, and other items necessary to install work.
 - 2. Material: Match floor divider strips.
- J. Adhesives and Sealants: Type as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify concrete floor surfaces are suitable for Thin-Set Epoxy Terrazzo installation.
 - 1. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
 - 2. Verify limits of moisture and alkalinity are within levels tolerated by Thin-Set Epoxy Terrazzo manufacturer and setting materials manufacturer.
- B. Examine substrate and conditions under which synthetic terrazzo is to be installed to determine unsatisfactory conditions.
 - 1. Correct unsatisfactory conditions and proceed with installation of synthetic terrazzo only substrate deficiencies have been corrected and surfaces are acceptable.
- C. Start of work constitutes acceptance of surfaces, and waiver of claim that surfaces are unsuitable.

3.2 PREPARATION

- A. Apply each component of the Thin-set Epoxy Terrazzo Flooring System in compliance with manufacturer's written installation instructions and strictly adhere to mixing and installation methods, recoat windows, cure times and environmental restrictions.
- B. Pre-treatment of cracks, construction joints, control joints and other non-moving joints:
 - 1. Treat with specified products in accordance with manufacturer's recommendations.
 - 2. Installed terrazzo system directly over non-moving joints and cracks which have been pre-treated.
- C. Expansion joints and similar moving joints:
 - 1. Terrazzo System to terminate at the edge of isolation and expansion joints as indicated.

3.3 INSTALLATION

- A. In addition to requirements of these specifications, comply with resin manufacturer's recommendations.
- B. Clean and prepare substrate as required to meet minimum tolerances required by manufacturer:
 - 1. Grind or shot-blast concrete surfaces as required.
 - 2. Acid etch is not acceptable.
 - 3. The prepared concrete shall have a surface profile equal to CSP3-5.
- C. Prime in accordance with manufacturer's instructions.
- D. Install divider and accessory strips in adhesive without voids below strips.
 - 1. Provide mechanical anchorage if required for adequate attachment.
 - 2. Integral Coves:
 - a. Install Cove Beads.
 - b. Install Cove Divider Strips.
 - 1) Align with floor divider strips.
- E. Mix and place matrix and aggregates.

1. Comply with time limitations and instructions for rolling, troweling, sprinkling additional aggregates and curing.
 2. Match selected sample.
 - a. Install where indicated.
- F. Rough grind, grout and finish grind in compliance with matrix manufacturer's instructions.
1. Use grit sizes required to match approved sample - 600 grit.
 2. Exercise extreme care to ensure that fluids from grinding operation do not react with metal strips to produce stains, or stain adjacent surfaces.
- G. Finish Sealer:
1. Seal surface with finish sealer after thoroughly curing and cleaning.
 - a. Wash surfaces with a neutral cleaner.
 - b. Rinse with clean water and allow surface to dry.
 - c. Apply sealer in accordance with sealer manufacturer's directions.
 - d. Apply sealer that will achieve COF to meet ADA guideline of .6.

3.4 PROTECTION

- A. Provide protection for finished work until building is ready for occupancy.

3.5 FINAL CLEANING

- A. Clean as recommended by system manufacturer when building is ready for occupancy.

END OF SECTION

SECTION 09 67 81
CONCRETE FLOOR SEALER (CFS-ND)

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Applicator must be a licensee of manufacturer, or approved in writing.

1.2 SUBMITTALS

- A. Project Information:
1. Maintenance data.
- B. LEED Information:
1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 2. EQ 4.2, Low-Emitting Materials – Paints and Coatings: Manufacturer’s product data indicating VOC content.

1.3 JOB CONDITIONS

- A. Install only when surface and ambient temperatures are between 95 and 60 degF.
- B. Install prior to other finishes.
- C. Provide adequate ventilation during installation.
- D. Post and enforce No Smoking signs.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
1. Concrete Floor Sealer – Normal Duty (CFS-ND):
 - a. Base:
 - 1) Symons.
 - b. Optional:
 - 1) Euclid Chemical Company.
 - 2) Nox-Crete.
- B. Concrete Floor Sealer – Normal Duty (CFS-ND):
1. Water-based, low VOC, acrylic copolymer solutions that cure, seal and dustproof concrete with minimal yellowing.
 2. Conform to ASTM-C309 and ASTM-C1315, Type I, Grade B, be VOC compliant, and meet all local air quality regulations.
 3. Conform to ASTM-C309 and ASTM-C1315, Type I, Grade B, with VOC content no greater than 100 g/L.
 4. Federal Spec: TT-C-800A.
 5. Minimum Solids Content: 30% by volume.
 6. Primer: As recommended by manufacturer.

7. Floor Sealer shall have a VOC content no more than 100 g/L in accord with SCAQMD Rule 1117.
8. Base Product:
 - a. Symons Cure & Seal 30 EF.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Verify that concrete was steel troweled and hair broomed and is free of fins, ridges or voids.
- B. Assure that curing agents used are compatible with coating system or completely removed.
- C. Concrete must be cured for minimum of 28 days, with moisture content not exceeding 8 percent.
- D. Remove surface contamination by cleaning or if necessary by sandblasting.
- E. Patch holes or voids.
- F. Rout out cracks exceeding 1/16 IN wide and calk.
- G. Calk non-moving joints up to 1 IN wide with suitable backer and sealant.
- H. Do not calk or overcoat joints where movement exceeds 25% or joints over 1 IN wide.
- I. These joints must receive other joint treatment to assure watertightness.
- J. Install test patch.
- K. If test patch indicates lack of adhesion, install primer.

3.3 INSTALLATION

- A. DO NOT apply to surfaces scheduled to subsequently receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.
- B. Apply by airless spray, long handled roller or brush.
- C. Apply in accordance with manufacturer's recommendations; minimum 2 coats.
- D. Apply first coat at not over 400 SF/GAL.
- E. Apply subsequent coat at a coverage rate not over 400 SF/GAL.
- F. Allow no traffic on sealed surface for 72 hours after application.

3.4 PATCHING AND CLEANING

- A. Patch areas which fail to match adjacent work.
- B. Clean surface "broom clean" after completion of work.
- C. Remove debris resulting from these operations.

END OF SECTION

SECTION 09 67 83
CONCRETE FLOOR SEALER/HARDENER (CFS-HD)

PART 1 - GENERAL

1.1 REFERENCES

- A. ASTM C 779/ C 779M Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.

1.2 QUALITY ASSURANCE

- A. Applicator must be a licensee of manufacturer, or approved in writing.

1.3 SUBMITTALS

- A. Contract closeout information:
 - 1. Maintenance data.
 - 2. Warranty.
- B. LEED Information:
 - 1. MR 5.1 & 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 2. EQ 4.2, Low-Emitting Materials – Paints and Coatings: Product data indicating VOC content of all paints and coatings.

1.4 JOB CONDITIONS

- A. Properly cure concrete prior to installation according to manufacturers recommendation .
- B. Install only when surface and ambient temperatures are above 40deg F (.
- C. Install prior to other finishes.

1.5 WARRANTY

- A. Written warranty signed jointly by applicator and manufacturer.
- B. Warranty to cover material performance for a period of 10 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Concrete Floor Sealer/Hardener (CFS-HD):
 - a. Base:
 - 1) L&M Construction Chemicals.
 - b. Optional:
 - 1) BASF Construction Chemicals.
 - 2. Other manufacturers desiring approval comply with Section 00 26 00.
- B. Concrete Floor Sealer/Hardener (CFS-HD):
 - 1. Chemical solution penetrating hardener/sealer.

2. Independent Test Data, ASTM C 779, Procedure A, a 50% or greater reduction of surface abrasion at the 30 minute time interval in comparison to untreated concrete.
3. Complies with all Federal and State VOC requirements.
4. VOC content shall be no greater than 100 g/L.
5. Surface Preparation: As recommended by manufacturer.
6. Base Product: "Seal Hard" by L&M.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Verify that concrete was troweled and hair broomed and is free of fins, ridges or voids.
- B. Assure that curing agents used are compatible with coating system or completely removed.
- C. Concrete must be cured for minimum of 28 days, with moisture content not exceeding 8 percent.
- D. Patch holes or voids.
- E. Rout out cracks exceeding 1/16 IN wide and calk.
- F. Calk non-moving joints up to 1 IN wide with suitable backer and sealant.
- G. Install test patch.
- H. If test patch indicates lack of adhesion, install primer as recommended by manufacturer.

3.3 INSTALLATION

- A. Apply by mechanical scrubber or bristle broom.
- B. Apply in accordance with manufacturer's recommendations but no less than 200 SF/GAL.
- C. Architect reserves right to require dry film thickness testing to prove compliance.
- D. Allow no traffic on sealed surface for 72 hours after application.

3.4 PATCHING AND CLEANING

- A. Patch areas which fail to match adjacent work.
- B. Clean surface "broom clean" after completion of work.
- C. Remove debris resulting from these operations.

END OF SECTION

SECTION 09 68 13
CARPET TILE (CPTT)

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. General requirements:
1. Manufacturer:
 - a. Carpet manufacturer shall have no less than 10 years of production experience with carpet similar to type specified in this document; and whose published product literature clearly indicate compliance of products with requirements of this section.
 - b. Single source responsibility: Provide product material by a single manufacturer for each carpet type specified.
 2. Trade Contractor: Firm with not less than five (5) years of successful carpeting experience similar to work of this section and recommended and approved by the carpet manufacturer. Upon request, submit letter from carpet manufacturer stating certification qualifications and acceptance.
 3. Substitutions: Where a selected manufacturer or product has been specified, an equal or superior product may be accepted only upon review and written acceptance by the Architect. It is mandatory that such review and approval be obtained prior to bidding, or the substitution will not be considered. All such proposed substitutions shall be submitted to the architect with all appropriate manufacturer's specifications and literature, and independent testing laboratory data. The architect's decision as to whether a product is equal or superior to the one specified shall be final. This section applies to any "or equal" noted in the specifications.
 4. Installer qualifications: Mill trained, skilled mechanics supervised by experienced superintendent with 50,000 yards experience.

1.2 SUBMITTALS

- A. Samples:
1. Three samples, minimum 18 x 36 IN, of each color specified in the Room Finish and Color Schedule, Section 09 06 10.
- B. Contract Closeout Information:
1. Warranty/Guarantee.
 2. Letter stating extra material has been delivered.
 3. Maintenance data.
 4. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
- C. LEED Information:
1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 3. EQ 4.1, Low-Emitting Materials, Adhesives & Sealants: Product data indicating that VOC levels of adhesives are in compliance with South Coast Air Quality Management District regulations.
 4. EQ 4.3, Low-Emitting Materials, Carpet Systems: Product data indicating that all carpet systems comply with Carpet and Rug Institute Green Label Plus program and carpet cushion complies with Carpet and Rug Institute Green Label program.
- D. Sustainable Design Information:
1. Provide product data for carpet that is listed in the USDA's BioPreferred Database or any other biobased component of carpet furnished.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver with mill register numbers attached.
- B. Tag and mark accessory items for identification.
- C. Store Carpet and related materials in a climate-controlled, dry space.
 1. Protect Carpet from soil, dust, moisture and other contaminants.
 2. Store on a flat surface.
 3. Do not stacking heavy objects on top of carpet packages.

1.4 JOB CONDITIONS

- A. Install after wall and other floor finishing operations in area are complete.
- B. Install after lighting system in area is complete.
- C. Install prior to acoustical ceiling tile.
- D. Maintain temperature of 65-95 DegF for not less than 48 hours prior to installation.
 1. Do not allow relative humidity to exceed 65%.
 2. Maintain same temperature and RH conditions throughout installation.

1.5 WARRANTY/GUARANTEE

- A. Guarantee entire carpet installation complies with specifications, and damaged or defective carpet or carpet stained by adhesives will be removed and replaced for a period of 2 years.
- B. Guarantee carpet color consisting of thermally pigmented yarns will not show significant change when exposed to normal light for period of 15 years.
 1. AATCC-16E.
- C. Guarantee carpet color will not show significant change when exposed to normal atmospheric contaminants for period of 15 years.
- D. Guarantee carpet will not show excessive wear for period of 15 years.
 1. Excessive wear is defined as wearing away of face yarns which reduces pile height by more than 15 percent in any area or pulling out of nap.
- E. Guarantee carpet backing structure will not delaminate from face structure and there will be no shrinkage or stretching affecting performance of face or backing structure for period of 15 years when installed and maintained in accordance with published procedures.
 1. Guarantee when installed and maintained in accordance with published procedures will not edge ravel for a period of 15 years.
 2. Guarantee ability of the carpet to lay flat; will not curl or dome.

- F. Guarantee entire cost of replacement, including removal, replacement, and disposal of defective carpet.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Carpet Tile (CPT):
 - a. Base:
 - 1) As noted in Room Finish and Color Schedule, 09 06 10.
 - 2. Optional manufacturers must meet the following performance criteria:
 - a. Nylon type 6 or type 6,6
 - b. Construction: loop
 - c. Tufted weight: 24 oz.
 - d. Stitches per inch: minimum 11.0
 - e. Gauge: 1/12
 - f. Tile size: 18"x36"
 - g. Electrostatic propensity: less than 3.5kv
 - h. Nbs smoke: less than 450
 - i. Radiant Panel: Class 1
 - j. 100% recyclable
 - k. 100% solution dyed.
 - l. Backing: polyolefin composite
 - m. Carpet may not contain PVC, phthalates, or PBD/PBDE
 - n. Surface treatments: non c8 fluorocarbon chemistry
 - o. Minimum recycled content (by weight): 39.6%
 - 1) Pre-consumer: 27.9%
 - 2) Post-consumer: 11.7%
 - p. 100% recyclable packaging
 - q. Manufactured in an ISO9001 & ISO 14001 certified facility or equivalent.
 - r. Third party certifications:
 - 1) MBDC cradle to cradle – silver certified
 - 2) NSF 140 – platinum certified
 - 3) CRI green label plus – certified
 - 4) USGBC LEED – contributes
 - 5) Green Label Plus certified by Carpet and Rug Institute
 - 6) Building Research Establishment – certified
 - 7) Good Environments Choice Australia – certified
 - 8) Good Environments Choice New Zealand – certified
 - 9) Singapore green label – certified
 - 3. Optional manufacturers must meet the following visual criteria:
 - a. Must match pattern and colorways per specified carpet, see Room Finish and Color Schedule, 09 06 10.
 - 4. Other manufacturers desiring approval comply with Section 00 26 00.
- B. Carpet Tile (CPT):
 - 1. First quality, no seconds or imperfections.
 - 2. Comply with applicable state and local codes.
- C. Carpet Edging Strips:
 - 1. Base Product: "Carpet to Resilient Transition 170" by BurkeMercer.
 - 2. Thickness to match carpet.
 - 3. Color as selected by Architect.
- D. Water vapor emission control system: See Section 09 60 05.

- E. Adhesive:
 - 1. Non-staining, non-bleeding strippable type.
 - 2. As recommended by carpet manufacturer with VOC content no greater than 50 g/L in accord with SCAQMD Rule #1168.

2.2 CARPET TYPES

- A. As specified in Room Finish and Color Schedule, Section 09 06 10.

2.3 EXTRA MATERIAL

- A. Furnish client with minimum of 5 percent additional material of each type, pattern and color for maintenance purposes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Concrete preparation for floor finishes: See Section 09 60 05.
- C. Verify concrete is sealed. New concrete requires approximately 90 days to cure.

3.2 PREPARATION

- A. Thoroughly clean areas to receive carpet tile, seal new concrete, strip waxes and finishes.
- B. Thoroughly remove dust and vacuum, also wet mop then seal concrete.
- C. Fill cracks, joints, holes or uneven areas with non-crumbling latex base floor filler such as Lev-L-Astic, patching compound must be mixed with latex mix not water.
- D. Before commencing work, test an area with glue and carpet tile to determine "open-time" and bond.
- E. Layout:
 - 1. Arrange joints symmetrically about centerline of rooms.
 - 2. Lay so pile and pattern of adjacent pieces match.
 - 3. Carefully check dimensions.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's instructions and recommendations for uniformity of direction, seam locations, and lay of carpet pile.
 - 2. Place tile with sight butted joints.
 - 3. Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
 - 4. Provide cut outs where required.
 - a. Conceal cut edges with protective edge guards or overlapping flanges.
 - 5. Run carpet under open-bottom items such as heating convectors and install tight against walls, columns and cabinets so entire floor area is covered with carpet.
 - a. Cover over all floor type door closers.
 - 6. Install edging guard at all openings and doors wherever carpet terminates, unless indicated otherwise.
 - a. Prior to installation, report to the Construction Manager all other obstructions which may occur.

7. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed, making sure carpet knives are sharp.
 8. Edges shall be butted together with the proper pressure to produce the tightest joint possible without distortion.
 9. All carpet shall be installed with pile-lay in the same direction.
 10. Use leveling compound where necessary.
 - a. Any floor filling or leveling shall have a minimum of 4 FT- 0 IN of feather.
 11. Expansion joints:
 - a. Do not bridge building expansion joints with continuous carpeting.
 - b. Provide for movements.
- B. Install in accordance with manufacturer's instructions.
1. Follow instructions on adhesives.
 - a. Adhesive must have recommended flash time before carpet is positioned.
 2. Do not mix dye lots in the same area.
 3. Install all carpet tiles so arrows point in the same direction.
 4. Install carpet tile in "brick" installation method.
- C. Where carpet terminates at non-carpeted floor surface, install Carpet Edging Strips (a.k.a. transition strips, reducer strips).
1. Install with contact adhesive.
 2. Score and trim narrow end of reducer strip to conform to adjacent floor finish.
- D. Install according to Architect's directions for overall patterns and borders.
1. Install carpet patterns according to drawings with no deviation.
 2. Develop templates as necessary.

3.4 CLEAN

- A. Remove spillage of glue or adhesive from face or seam using remover provided by manufacturer.
- B. Clean spots; remove loose threads with broadloom scissors.
- C. Completely and thoroughly vacuum using a pile lifter.
- D. Advise maintenance personnel regarding care and maintenance.
- E. Save cuts over 9 IN for Laboratory stock.

3.5 PROTECTION

- A. After cleaning and prior to final acceptance, protect carpeting subject to traffic with nonstaining building material paper runners or other approved material.
- B. Protect installation from rolling traffic by using sheets of hardboard or plywood in potentially affected areas
- C. Protect carpeting against damage during construction:
 1. Cover with nonstaining building material paper with taped joints during the construction period, wherever protection is required, so carpet will be without any indication of deterioration, wear, or damage at the time of acceptance.
 2. Damaged carpeting will be rejected.
 3. As the carpet is laid, remove trimmings, excess pieces of carpet and laying materials from each area as it is completed.
- D. Maintain protection of carpeting on each floor or area until accepted, without waiting until the entire project is complete.

3.6 INSPECTION

- A. Upon completion of the installation inspect installation and verify work is complete, properly installed, and acceptable.
- B. Remove and replace work not found acceptable at the installer's expense.

END OF SECTION

SECTION 09 72 33
DRY ERASE WALL COVERING (DWC)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Dry Erase Wall Covering, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM-E84, Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM-D751, Methods of Testing Coated Fabrics.
- C. UL-723, Test for Surface Burning Characteristics of Building Materials
- D. Gypsum Association, GA-14-M-97, Recommended Levels of Gypsum Board.
- E. Each type of dry erase wallcovering required shall be produced by the same manufacturer.
- F. Installation by skilled commercial wallcovering applicators with no less than three years of documented experience installing dry erase wallcovering of the types and extent required.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Wall covering materials, adhesives and accessories.
- B. Shop drawings showing elevation of applicable area including metal trim detailing.
- C. Samples:
 - 1. Three 7 x 9 IN samples of each type of wall covering specified.
 - 2. 6 IN lengths of specified trim and accessory items.
- D. Contract Closeout information:
 - 1. Maintenance Data.
 - 2. Warranty.
 - 3. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- E. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.

1.4 WARRANTY

- A. Manufacturer's written warranty against manufacturing defects.
- B. Warranty period: 5 years.

1.5 PROJECT CONDITIONS

- A. Do not apply dry erase wallcoverings when surface and ambient temperatures are outside the temperature ranges required by the wallcovering manufacturer.
- B. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 55 degrees F unless required otherwise by manufacturer's instructions.
- C. Apply adhesive when substrate surface temperature and ambient temperature is above 55 degrees F and relative humidity is below 40 percent.
- D. Maintain constant recommended temperature and humidity for at least 72 hours prior to and throughout the installation period, and for 72 hours after wallcovering installation completion.
- E. Provide not less than an 80 foot-candles per square foot lighting level measured mid-height at substrate surfaces.

1.6 MAINTENANCE

- A. Maintenance data: Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Dry Erase Wallcoverings:
 1. Base:
 - a. As noted in Room Finish and Color Schedule, 09 06 10.
 - b. Optional:
 - 1) Speak easy Dry Erase Wallcovering – Hirschfield's
 - 2) Walltalkers Wallcoverings, RJF International Corporation.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Dry Erase Wallcoverings – Schedule of Types:
 - a. Provide dry erase wallcoverings as noted in Room Finish and Color Schedule, 09 06 10.
 2. Provide in the length and widths called out or indicated.
- B. Fire Hazard Classification:
 1. Provide materials that comply with NFPA Class A fire rating when tested in accordance with ASTM-E84.
 2. Identify components with markings from testing and inspection organization.
- C. Field Samples: Prepare field samples for Architect's review and establish requirements for seaming and finish trim.
 1. Install sample panel of each type presentation wallcovering specified in area designated by Architect.
 2. Maintain corrected and approved samples to serve as a standard of performance for the project.

2.3 ACCESSORIES

- A. Adhesives: Heavy-duty clear premixed vinyl adhesive or clay based adhesive.
 - 1. Adhesives shall have a VOC content no greater than 70 g/L.
- B. Substrate Primer/Sealer: White pigmented acrylic base primer/sealer specifically formulated for use with vinyl wallcoverings.
- C. Marker and Eraser Trays.
 - 1. Aluminum:
 - a. Anodized aluminum.
 - b. Finish:
 - 1) Clear.
 - c. Length: Run entire length of wallcovering, with one continuous piece.
 - d. Height: 32IN AFF.
- D. Trim:
 - 1. Aluminum:
 - a. Anodized aluminum.
 - b. Finish:
 - 1) Clear.
 - c. Length: Run entire height of wallcovering
 - d. Location: At side end locations of wallcovering at transition between wallcovering corners.
- E. Paper Rail:
 - 1. Aluminum Paper Rail.
 - 2. Length: Run entire length of wallcovering, with one continuous piece.
 - 3. Location: At top location of wallcovering at transition between wallcovering and painted drywall.
 - 4. Height: 86 IN AFF.
- F. Supplies:
 - 1. Provide one starter kit containing eight dry erase markers, two erasers, 10 cleaning towels, and one 8 ounce bottle liquid surface cleaning solution for each room installed with dry erase wallcovering.
 - 2. Provide type of markers and erasers which are compatible for each type of dry erase wallcovering specified.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 4 finish, GA-214-M-97, Recommended Levels of Gypsum Board Finish.
- B. Test substrates with a suitable moisture meter and verify that moisture content does not exceed 4 percent.
- C. Verify substrate surfaces are clean, dry, smooth, structurally sound and free from surface defects and imperfections that would show through the finished surface.
- D. Evaluate all painted surfaces for the possibility of pigment bleed-through.
- E. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- F. Beginning of installation means acceptance of surface conditions.

3.2 INSTALLATION – WALLCOVER BACKING

- A. Acclimate wallcovering in the area of installation a minimum of 24 hours before installation.
- B. Read and follow the instructions in the manufacturer's installation sheet contained in each roll of the dry erase wallcovering.
- C. Examine all materials for pattern, color, quantity and quality as specified for the correct location prior to cutting.
- D. Adhesive: Use heavy-duty pre-mixed strippable clear or clay-based vinyl adhesive, such as: Koroseal A-848-B or other high quality adhesive recommended for fabric backed vinyl wallcovering and approved by manufacturer.
- E. Primer: Use a pigmented primer on deep colored walls and walls with contrasting colors.
- F. Install each roll in sequence starting from the highest to the lowest number and each strip in the same sequence as cut from the roll.
- G. Install dry erase wallcovering panels in exact order as they are cut from bolt.
 - 1. Reverse hang alternate strips.
 - 2. Do not crease the wallcovering.
- H. Install dry erase wallcovering horizontally using a level line.
 - 1. Using level or straight edge, double cut the seam with a new razor or knife.
- I. When covering the entire wall, seam the material out of the main writing and viewing areas of the wall.
- J. Smooth wallcovering to the hanging surface using a wallcovering smoother, wrapped with a soft cloth, to eliminate air bubbles, wrinkles, gaps and overlaps.
 - 1. Do not use sharp edged smoothing tools. Smooth material on the wall from the middle to the outside edge.
- K. Remove excess adhesive along finished seams immediately after each wallcovering strip is applied.
 - 1. Clean entire surface with warm, mild soap solution, a natural sponge and clean towels. Rinse thoroughly with water and let dry before using.
 - 2. Change water often to maintain water cleanliness.
- L. Stop installation of material that is questionable in appearance and notify the manufacturer's representative for an inspection.

3.3 CLEAN-UP

- A. Upon completion of installation, wash the wall covering with an ammonia or alcohol-based cleaner or mild soap and rinse thoroughly with water prior to using.
- B. Upon completion of the work, remove surplus materials, rubbish and debris resulting from the wallcovering installation. Leave areas in neat clean and orderly condition.

END OF SECTION

SECTION 09 77 73
METAL COLUMN COVERS (INTERIOR)

PART 1 - GENREAL

1.1 SUMMARY

- A. Work of this section includes materials, accessories and related items for the complete installation of Interior Metal Column Covers.
 - 1. Include necessary internal supports/stiffeners and related items for solid attachment of cover to building superstructure.
 - 2. Include Sealants (specified in Section 07 92 16) as required.
- B. Metal Column Covers to be installed on the Exterior: Specified in Section 07 77 13.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufactures having a minimum of 5 years experience in manufacturing architectural metals

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit complete shop drawings indicating quantities, finishes, dimensions, joint types, and attachment methods.
- B. Product Data:
 - 1. Submit manufacturer's product data, specifications, brochures and installation instructions for each type of column cover required.
- C. Samples:
 - 1. Submit color and finish samples to determine range of texture and consistency of color and finish to be expected in the finished work.
 - a. Minimum Size: 3 IN x 5 IN.
- D. Contract Closeout Information:
 - 1. Maintenance Data.
 - 2. Warranty on PVDF coatings.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver components in clearly marked containers and packages suitable for shipment of specified products so as to prevent finish damage in transit.
 - 1. Provide protective wrapping or film to provide protection.
- B. Store components in locations that will avoid damage from job-site traffic, moisture, stacking or other job-site contamination.
- C. Handle components to avoid racking, twisting, denting or scratching of finished surfaces.

1.5 WARRANTY

- A. Manufacturer's warranty against defects in material and workmanship for a period of 1 year.
- B. Finish Warranty (PVDF Coating):

1. Warrant PVDF (Fluoropolymer) coating to remain free from peeling, checking, cracking, chalking in excess of numerical rating of 8 when measured in accord with ASTM-D4214, of fading in excess of 5 N.B.S. Units.
 - a. Warranty period: 20 years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Metal Column Covers (Interior):
 - a. Base:
 - 1) Fry Reglet.
 - b. Optional:
 - 1) Una-Clad, Copper Sales Inc..
 - 2) Industrial Louvers, Inc.
 - 3) MM Systems Corporation.
 - 4) Pittcon Industries.
 - 5) Southwest Metalsmiths, Inc.
 - 6) Metal Sales and Service, Inc. (Metalwerks).
 - B. Ceiling Collars:
 - a. Base:
 - 1) Fry Reglet.
 - b. Optional:
 - 1) Pittcon Industries.
2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 TYPE 12 – BUTT JOINT W/ KEY SLOT FASTENERS

- A. General:
 1. Attachment design must be “removable” for easy access in future.
 2. Design must permit vertical stacking.
 3. Base Product: “Series KS – Key Slot Connection” by Fry Reglet.
- B. Material:
 1. Aluminum:
 - a. Type 3003-H14, 5005-H34 (anodized) or 5052-H32 alloy complying with ASTM-B209.
 - b. Thickness:
 - 1) 0.125 IN.
 - c. Factory Finish:
 - 1) Clear anodized.
- C. Configuration:
 1. Shape(s): As indicated.
 2. Size(s): As indicated.
- D. Vertical Joint Type:
 1. Butt Joint (soft vee) with concealed key slot (slip connection) fastening mechanism.
- E. Horizontal Joints:
 1. Ceiling/Soffit Joints:
 - a. Through ceiling/soffit, with Ceiling Collar.
 2. Intermediate Joints:
 - a. Inset reveal joint.
 3. Floor:
 - a. Flush to floor.
- F. Support Posts:

1. Provide steel supports as required.
 2. Brace to building column as required.
 3. Refer to "INTERNAL SUPPORTING DEVICES - GENERAL REQUIREMENTS" for additional design criteria.
- G. Fabrication of Type 12 Metal Column Covers:
1. Column covers shall be self aligning with attachment clips at not more than 18 IN apart to assure solid attachment to post structures.
 2. Provide column covers in "detachable" sections a maximum 12 FT tall per section.
 - a. Provide additional sections to achieve finished heights above 12 FT.

2.3 INTERNAL SUPPORTING DEVICES – GENERAL REQUIREMENTS

- A. Design and provide internal supporting devices as required to resist the following:
1. Dead Load of Metal Column Covers.
 2. Lateral Live Loads (positive and negative direction) as appropriate for installation:
 - a. Interior Units (typical):
 - 1) Maximum Deflection: L/240 at 5 PSF uniform load.
 - b. Interior Units (in vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions):
 - 1) Maximum Deflection: L/240 at 15 PSF uniform load.
- B. Material(s):
1. Aluminum and/or Steel items as determined by Column Cover manufacturer.
 2. Include fasteners, wood blocking and shims, sealants and required items.
 3. Refer to description of each Column Cover Type for additional, specific information.

2.4 CEILING COLLARS

- A. General:
1. Utilize Ceiling Collars where Column Covers are scheduled to pass through ceilings and/or soffits.
 2. Fabricate to match profile and dimension of column covers.
 3. Utilize the following type(s):
- B. Shadow Trim:
1. W-profile.
 2. Vertical flange fixed to column cover; horizontal flange supporting ceiling finish.
 3. Material: 6063 T5 Aluminum.
 4. Finish (where exposed to view):
 - a. Clear Anodized.
 5. Reveal Width x Depth: 3/4 IN x 3/4 IN.
 6. Base Product: "Reveal Column Ring" by Fry Reglet.
 - a. Use model variations as appropriate for Scheduled Ceiling/Soffit Type (i.e. GWB, Plaster or Lay-in).

2.5 FABRICATION – GENERAL REQUIREMENTS

- A. General:
1. Form column covers to specified dimensions and diameters indicated.
 2. Form radii to achieve true and smooth curves as indicated.
 3. All fasteners shall be concealed from view.
 4. Provide additional bracing components as necessary to stiffen substructure and insure solid mid-span bracings and connections.
 5. Refer to description of each Column Cover Type for additional, specific fabrication information.
- B. Fabricate Column Covers true to dimension and geometry indicated within the following allowable fabrication tolerances:
1. Maximum Deviation Design Dimensions: +/- 1/16 IN.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine job-site conditions for conditions that may adversely affect installation of column covers.
- B. Verify dimensions of column covers prior to installation to assure compatibility with job-site conditions.
- C. Verify post structure is plumb, level, and parallel prior to installation of column covers.
- D. Inspect Column Covers prior to installation, to ensure units are free from dents, scratches and other defects.
 - 1. Replace or repair defective units prior to installation.

3.2 PREPARATION

- A. Verify/coordinate with other trades prior to installation insofar as they are affected by column cover installation.

3.3 INSTALLATION – COLUMN COVER

- A. Install components in accord with manufacturer's installation instructions and approved shop drawings.
- B. Column Covers shall be erected plumb, level, square, true to line, securely anchored, and in proper alignment and relationship to work for other trades.
 - 1. Anchor components to related structures such as floors, walls and beams as indicated on approved shop drawings.
 - 2. Use anchors with sufficient holding strength to ensure a solid installation.
 - 3. Use only plated, galvanized or stainless steel anchors (as compatible with cover material(s) specified).

3.4 INSTALLATION - CEILING COLLARS

- A. Set level, and at appropriate elevation to receive finished ceiling.
- B. Mechanically attach vertical flange of Ceiling Collar to face of Column Cover.

3.5 CLEANING

- A. Remove protective coverings and clean column covers to remove adhesives and tape residue. Test solvents on non-exposed surfaces prior to use.
 - 1. For painted surfaces, use a mild detergent solution on a soft cloth.
 - 2. For stainless steel, use a glass cleaner and a soft cloth.
 - 3. For other surfaces, contact manufacturer for proper cleaning procedures.
- B. Visually inspect exposed surfaces for scratches or blemishes.
- C. Protect column covers from damage during remainder of construction period.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Definitions:
 - 1. "Paint" and "painting" refer to applied coatings.
 - 2. Mechanical work (and equipment): Work included in Mechanical Specification Divisions.
 - 3. Electrical work (and equipment): Work included in Electrical Specification Divisions.
- B. Work included:
 - 1. Exterior surfaces scheduled to be painted, unless indicated to be painted under other sections.
 - 2. Except for colored, split-face, patterned, ground-face, glazed, and other concrete masonry units with integral architectural finish; paint exposed exterior and on-site concrete masonry unit surfaces, including areaway walls, backside faces of parapets, screen walls, and retaining walls.
 - 3. Paving Striping and Marking: See Section 32 17 23.
 - 4. Mechanical and electrical work:
 - a. Exterior equipment and items not completely factory finished.
- C. Mechanical/Electrical Painting:
 - 1. Work included:
 - a. Mechanical equipment.
 - b. Electrical equipment.

1.2 QUALITY ASSURANCE

1.3 SUBMITTALS

- A. Product data:
 - 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
- B. Samples:
 - 1. Manufacturers complete range of colors for selection.
 - 2. Gloss samples.
- C. Contract closeout information:
 - 1. Maintenance data.
- D. LEED Information:
 - 1. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver in original labeled containers.
- B. Protect from freezing or damage.
- C. Store materials in place designated by Laboratory or Architect.
- D. Keep storage neat and clean.

- E. Repair damage thereto or to surroundings.
- F. Remove rags and waste from building daily.
- G. Avoid danger of fire.

1.5 JOB CONDITIONS

- A. Install when temperature, humidity, and surface conditions are acceptable to manufacturer.
- B. Maintain schedule indicating when painter expects to complete respective coats of paint for various areas.
 - 1. Keep schedule current as job progress dictates.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Provide paint as product of one manufacturer as far as possible.
 - 2. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
 - a. Use comparable performance and aesthetic requirements for paints by Optional manufacturers.
 - 3. Paints:
 - a. Base:
 - 1) Sherwin-Williams.
 - 2) As noted for individual types in Room Finish and Color Schedule.
 - b. Optional:
 - 1) Benjamin Moore.
 - 2) Glidden Professional.
 - 3) PPG Architectural Finishes.
 - 4) Pratt & Lambert.
 - 5) Kwal Paint.
 - 6) Tnemec.
- B. Paints and stains: As Scheduled in Part 3.
 - 1. Unscheduled items: Bring to the attention of Architect.
 - 2. Colors:
 - a. Architect reserves right to select colors from entire range of manufacturer's colors, including deep colors.
 - b. Mechanical: See Section 20 05 53.
 - 3. Gloss range: MPI Standards as measured in accordance with ASTM-D523:
 - a. Gloss Level 1 (Flat): Maximum 5 at 60 degrees, maximum 10 at 85 degrees.
 - b. Gloss Level 2 (Velvet): Maximum 10 at 60 degrees, 10-35 at 85 degrees.
 - c. Gloss Level 3 (Eggshell): 10-25 at 60 degrees, 10-35 at 85 degrees.
 - d. Gloss Level 4 (Satin): 20-35 at 60 degrees, minimum 35 at 85 degrees.
 - e. Gloss Level 5 (Semi-gloss): 35-70 at 60 degrees.
 - f. Gloss Level 6 (Gloss): 70-85 at 60 degrees.
 - g. Gloss Level 7 (High gloss): More than 85 at 60 degrees.
 - 4. If the gloss range is not indicated, provide top coat with a MPI Gloss Level 3 (Eggshell) finish.
 - 5. Submit gloss samples for approval prior to use.
 - 6. Add flatteners if necessary to achieve specified gloss.
 - 7. Part 3 includes a listing of surfaces and type of paint to be applied.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces carefully for defects which cannot be corrected and might prevent satisfactory results.
- B. Commencing of work in a specific area constitutes acceptance of surfaces, and responsibility for performance.

3.2 SURFACES NOT TO BE PAINTED

- A. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
- B. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.
- C. Code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
 - 1. Embossed plates and labels stamped into frames will be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.
- D. Equipment identification or rating plates.
- E. Items having complete factory finish:

3.3 PREPARATION - GENERAL

- A. Assure that surfaces are clean and dry.
- B. Assure that surfaces are free of foreign materials which will affect adhesion or appearance.
- C. Remove mildew and neutralize surface.
- D. Eliminate efflorescence before painting.
- E. Before painting, test surfaces with moisture meter.
- F. Paint when moisture is within paint manufacturer's acceptable limits.

3.4 PREPARATION - EXISTING SURFACES

- A. Wherever existing work is cut, patched, or added to; touch up to match new work as closely as possible.
 - 1. Check compatibility of new coating to previously painted surfaces by applying test patch. Allow to dry and test adhesion before continuing painting work.
- B. Put existing work scheduled for repainting in condition to provide good adhesion and to receive paint.
 - 1. Wash thoroughly surfaces to be repainted with abrasive kitchen cleaner or sand to manufacturer's recommendations.
 - 2. Remove residue from cleaning and abrading procedures.
 - 3. Spot prime bare areas.
- C. Where a wall or ceiling is disturbed and patched, repaint entire wall or ceiling.
- D. On surfaces to be refinished remove hardware, accessories, plates, surface mounted lighting fixtures, and similar items not to be coated, or provide protection during preparation and coating operations.
- E. Protect (and do not paint) code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
 - 1. Embossed plates and labels stamped into frames may be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.
- F. Move items as required to paint existing surfaces.

1. Coordinate storage location with Laboratory.
2. Coordinate mechanical, electric or plumbing service interruptions with other trades and Laboratory.
3. Replace items to original location.

3.5 MATERIAL PREPARATION

- A. Mix and prepare materials per manufacturer's specifications.
- B. Stir, agitate or blend materials to produce a mixture of uniform density as required for application of materials.

3.6 PREPARATION - FERROUS METAL SURFACES AND HOLLOW METAL

- A. Follow requirements of SSPC SP1 and SP3.
 1. Except where higher prep levels are indicated.
- B. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
- C. Touch up damaged shop coats.
- D. For surfaces with touched up shop coat, omit first coat.
- E. Hollow metal frame joints at intersections of Rabbets, Stops, and Soffit Joints:
 1. Neatly fill corner seam with painter's caulk (in field) prior to painting.

3.7 PREPARATION - GALVANIZED METAL SURFACES AND NON-ANODIZED ALUMINUM

- A. Follow requirements of SSPC SP1.
- B. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.

3.8 PREPARATION - NEW CONCRETE SURFACE

- A. Repair minor defects.
- B. Flush clean with water.
- C. Apply Tenant 409 Pre-Kote/Cleaner to manufacturer's specifications.

3.9 APPLICATION - GENERAL

- A. Paint surfaces as specified in paragraphs "Schedule - Exterior Paint Systems".
- B. Provide complete coverage and hide.
 1. Paint systems are to cover.
 2. When color or undercoats show through, apply additional coats at no additional cost until paint film is of uniform finish and color.
- C. Employ only skilled mechanics.
- D. Mix and apply as recommended by manufacturer.
- E. If Architect so directs, do not apply succeeding coats until Architect has an opportunity to observe previous coat.
- F. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
- G. Upon completion of painting, carefully replace removed items and/or remove protection.
- H. Apply materials under adequate illumination.
- I. Evenly spread and smoothly flow on for full, smooth cover.

- J. Assure that coats are dry before recoating.
- K. Touch up suction or hot spots in plaster, concrete block, and concrete before painting.
- L. Touch up abraded areas of shop prime coats before subsequent coats are applied.
- M. Back prime wood trim with penetrating sealer.
- N. Finish colors not indicated shall be selected by Architect from paint manufacturer's standard colors.

3.10 PROTECTION AND CLEANUP

- A. Protect adjacent work against damage by painting and finishing work.
- B. Clean, repair or replace, and repaint damaged work as directed by Architect.
- C. Provide "WET PAINT" signs.
- D. Remove temporary protective wrappings, after completion of operations.
- E. Clean paint spattered surfaces.
- F. Use care not to damage finished surfaces.
- G. Remove surplus materials, scaffolding and debris.
- H. Leave areas broom clean.

3.11 SCHEDULE - EXTERIOR PAINT SYSTEMS

- A. Concrete and GFRC:
 - 1. Elastomeric, textured:
 - a. Sherwin Williams:
 - 1) Primer coat: Loxon Acrylic Primer; A24 W300.
 - 2) Intermediate coat: ConFlex XL Elastomeric High Build Smooth; A5-400.
 - 3) Topcoat: ConFlex XL Textured Elastomeric High Build Medium; A5-800.
 - b. ICI:
 - 1) Primer coat: Prep & Prime Hydrosealer Waterborn Multipurpose Primer Sealer; 6001.
 - 2) Intermediate coat: Decra-Flex 300 Elastomeric Coating; 2290.
 - 3) Topcoat: Exterior: Decra-Flex 300 Elastomeric Coating; 2290.
 - c. PPG:
 - 1) Primer coat: Perma-Crete Acrylic Primer; 4-2.
 - 2) Intermediate coat: Pitt Flex Elastomeric; 4-110.
 - 3) Topcoat: Pitt Flex Elastomeric Textured; 4-210.
- B. Concrete block:
 - 1. Elastomeric, textured:
 - a. Sherwin Williams:
 - 1) Primer coat: Loxon Block Surfacer; A24 W200.
 - 2) Intermediate coat: ConFlex XL Elastomeric High Build Smooth; A5-400.
 - 3) Topcoat: ConFlex XL Textured Elastomeric High Build Medium; A5-800.
 - b. Benjamin Moore:
 - c. ICI:
 - 1) Primer coat: Bloxfil Interior/Exterior Heavy Duty Acrylic Block Filler; 4000.
 - 2) Intermediate coat: Decra-Flex 300 Elastomeric Coating; 2290.
 - 3) Topcoat: Exterior: Decra-Flex 300 Elastomeric Coating; 2290.
 - d. PPG:
 - 1) Primer coat: Perma-Crete Block Surfacer; 4-100.
 - 2) Intermediate coat: Pitt Flex Elastomeric; 4-110.
 - 3) Topcoat: Pitt Flex Elastomeric Textured; 4-210.

- C. Metal doors and frames; Metal stairs, handrails, and guardrails; Miscellaneous metals (ferrous, primed, zinc-coated, and aluminum):
 - 1. Water based urethane, Gloss Level 6 (Gloss):
 - a. Sherwin Williams:
 - 1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
 - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - b. Glidden Professional:
 - 1) Primer coat: Universal Epoxy Primer; 205.
 - 2) Intermediate coat: Devthane UVA Aliphatic Urethane; 379.
 - 3) Topcoat: Devthane UVA Aliphatic Urethane; 379.
 - c. PPG:
 - 1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
 - 2) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
 - 3) Topcoat: Durethane WB Water Based Urethane; 98-8200.
- D. Structural steel (exposed):
 - 1. Water based urethane, Gloss Level 6 (Gloss):
 - a. Sherwin Williams:
 - 1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
 - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - 4) Clear coat: Diamond-Clad Clear Coat Urethane, B65 Series.
 - b. Glidden Professional:
 - 1) Primer coat: Devran Epoxy High Build Coating; 224HS.
 - 2) Intermediate coat: Devthane UVA Aliphatic Urethane Gloss Enamel; 389.
 - 3) Topcoat: Devthane UVA Aliphatic Urethane Gloss Enamel; 389.
 - c. PPG:
 - 1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
 - 2) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
 - 3) Topcoat: Durethane WB Water Based Urethane; 98-8200.
 - 4) Clear coat: Durethane WB Water Based Urethane; 98-8200.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Definitions:
 - 1. "Paint" and "painting" in this section refers to applied coatings, except for exterior painting specified in Section 09 91 13.
 - 2. Finished room or space: One that has finish called for on Room Finish and Color Schedule.
 - 3. Mechanical work (and equipment): Work included in Mechanical Specification Divisions.
 - 4. Electrical work (and equipment): Work included in Electrical Specification Divisions.
- B. Work included:
 - 1. Interior surfaces in finished rooms or spaces, unless indicated not to be painted or indicated to be painted under other sections.
 - 2. Mechanical and electrical work:
 - a. Interior mechanical and electrical equipment not completely factory finished.
 - b. In finished rooms and spaces with finished ceilings: Exposed ductwork, piping, insulated piping, conduit, busways, raceways, and associated accessories.

1.2 SUBMITTALS

- A. Product data:
 - 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
- B. Samples:
 - 1. Manufacturers complete range of colors for selection.
 - 2. Three 8-1/2 IN x 11 IN samples of each paint as selected in Room Finish and Color Schedule, as shown on Drawings.
 - a. Samples shall show specified color and finish.
 - 3. Gloss samples.
- C. Contract closeout information:
 - 1. Maintenance data.
- D. LEED Information:
 - 1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 2. LEED Credit EQ 4.2, Low-Emitting Materials, Paints and Coatings: Manufacturer's product data for paints and coatings, included printed statement of VOC content and chemical components and material safety data sheets.
 - a. Provide VOC data and gallons furnished for each coating.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver in original labeled containers.
- B. Protect from freezing or damage.
- C. Store materials in place designated by Laboratory or Architect.
- D. Keep storage neat and clean.

- E. Repair damage thereto or to surroundings.
- F. Remove rags and waste from building daily.
- G. Avoid danger of fire.

1.4 JOB CONDITIONS

- A. Install when temperature and humidity conditions approximate conditions that will exist when building is occupied. Maintain conditions after installation.
- B. Install prior to adhesively applied flooring and wall covering.
- C. Install prior to carpet and acoustical material.
- D. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- E. Air out construction with 100% outside air.
 - 1. Do not recirculate prior to occupancy.
 - 2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.
- F. Maintain schedule indicating when painter expects to complete respective coats of paint for various areas.
 - 1. Keep schedule current as job progress dictates.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Provide paint as product of one manufacturer as far as possible.
 - 2. Paint, stain, and coating systems listed are Sherwin Williams, Benjamin Moore, Glidden Professional and PPG products.
 - a. Use comparable performance, environmental, and aesthetic requirements for paints by other listed manufacturers.
 - b. Manufacturers listed in Room Finish and Color Schedule are for color reference only.
 - 3. Paints:
 - a. Sherwin-Williams.
 - b. Benjamin Moore.
 - c. Glidden Professional.
 - d. PPG Architectural Finishes.
 - e. Pratt & Lambert.
 - 4. Stains:
 - a. Sherwin-Williams.
 - b. Benjamin Moore.
 - c. Glidden Professional.
 - d. PPG Architectural Finishes.
 - e. Pratt & Lambert.
- B. Paints and stains: As scheduled in Part 3.
 - 1. Unscheduled items: Bring to the attention of Architect.
 - 2. Colors: As noted in Room Finish and Color Schedule and as indicated in Section 20 05 53.
 - a. Architect reserves right to select accent colors from entire range of manufacturer's colors, including deep colors.
 - b. Architect reserves right to require that one or more walls in a room or space be painted a contrasting accent color, except in janitor's and electric closets and other small miscellaneous rooms and spaces.
 - c. Primer color: White.

- 1) Bold, deep, vivid, and transparent top coats: Gray tint.
 - a) Coordinate with top coat color.
 3. Gloss range: MPI Standards as measured in accordance with ASTM-D523:
 - a. Gloss Level 1 (Flat): Maximum 5 at 60 degrees, maximum 10 at 85 degrees.
 - b. Gloss Level 2 (Velvet): Maximum 10 at 60 degrees, 10-35 at 85 degrees.
 - c. Gloss Level 3 (Eggshell): 10-25 at 60 degrees, 10-35 at 85 degrees.
 - d. Gloss Level 4 (Satin): 20-35 at 60 degrees, minimum 35 at 85 degrees.
 - e. Gloss Level 5 (Semi-gloss): 35-70 at 60 degrees.
 - f. Gloss Level 6 (Gloss): 70-85 at 60 degrees.
 - g. Gloss Level 7 (High gloss): More than 85 at 60 degrees.
 4. If the gloss range is not indicated, provide top coat with a MPI Gloss Level 3 (Eggshell) finish.
 5. Submit gloss samples for approval prior to use.
 6. Add flatteners if necessary to achieve specified gloss.
 7. Part 3 includes a listing of surfaces and type of paint to be applied.
- C. LEED Requirements:
1. Flats: VOC content shall be no greater than 50 g/L.
 2. Non-Flats and Primers: VOC content shall be no greater than 150 g/L.
 3. Anti-corrosive paint applied to interior ferrous surfaces VOC content shall be no greater than 250 g/L.
 4. Varnish: VOC content shall be no greater than 350 g/L.
 5. Lacquer: VOC content shall be no greater than 550 g/L.
 6. Stains: VOC content shall be no greater than 250 g/L.
 7. Sanding Sealers: VOC content shall be no greater than 275 g/L.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces carefully for defects which cannot be corrected and might prevent satisfactory results.
- B. Commencing of work in a specific area constitutes acceptance of surfaces, and responsibility for performance.

3.2 SURFACES NOT TO BE PAINTED

- A. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
- B. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.
- C. Code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
 1. Embossed plates and labels stamped into frames will be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.
- D. Equipment identification or rating plates.
- E. Items having complete factory finish with exception of:
 1. Electrical panels.
 2. Control cabinets.
 3. Similar surfaces in finished areas.

3.3 PREPARATION - GENERAL

- A. Assure that surfaces are clean and dry.
- B. Assure that surfaces are free of foreign materials which will affect adhesion or appearance.
- C. Remove mildew and neutralize surface.

- D. Eliminate efflorescence before painting.
- E. Before painting, test surfaces with moisture meter.
- F. Paint when moisture is within paint manufacturer's acceptable limits.

3.4 MATERIAL PREPARATION

- A. Mix and prepare materials per manufacturer's specifications.
- B. Stir, agitate or blend materials to produce a mixture of uniform density as required for application of materials.

3.5 PREPARATION - WOOD

- A. General:
 - 1. Immediately before applying finish:
 - a. Sand all surfaces with 180-grit, or finer, as necessary to accomplish the following:
 - 1) Remove fingerprints and other marks which may have occurred during shipment to site and during installation.
 - 2) Restore surface to smooth surface texture.
 - 3) Prepare grain to receive finish.
 - b. Remove dust.
- B. Opaque Finishes:
 - 1. After priming coat has dried, seal knots, pitch and resinous sapwood.
- C. Stained and Clear Finishes:
 - 1. Treat wood with compatible wash-coat prior to stain application.
 - 2. Putty nail holes and minor defects, to match wood color.

3.6 PREPARATION - FERROUS METAL SURFACES AND HOLLOW METAL

- A. Follow requirements of SSPC SP1 and SP3.
 - 1. Except where higher prep levels are indicated.
- B. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
- C. Touch up damaged shop coats.
- D. For surfaces with touched up shop coat, omit first coat.
- E. Hollow metal frame joints at intersections of Rabbets, Stops, and Soffit Joints:
 - 1. Neatly fill corner seam with painter's caulk (in field) prior to painting.
- F. For windows, and door assemblies that access to, or egress out directly from the Clean Zone, or are interior to the Clean Zone such that they are in contact with the clean air management systems, provide paint system PNTE-CR to the cleanroom side and half of the edges and frames.

3.7 PREPARATION - GALVANIZED METAL SURFACES AND NONANODIZED ALUMINUM

- A. Follow requirements of SSPC SP1.
- B. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.

3.8 PREPARATION - GYPSUM WALLBOARD

- A. Repair minor irregularities left by finishers.
- B. Exercise care to avoid raising nap of paper.
- C. Apply prime coat.

- D. Notify gypsum wallboard finisher to repair and refinish areas which indicate defects after application of primer.
- E. Re-prime refinished areas.

3.9 PREPARATION – CONCRETE AND MASONRY

- A. Repair minor defects.
- B. Remove oil from concrete by washing with xylol.
- C. Block Filler:
 - 1. Apply masonry to fill pinholes and minor surface defects, and to prime surface for topcoat(s).
 - 2. Apply by brush, roller or sprayer.
 - a. Where spray-applied: Back-roll with roller or squeegee.
 - 3. Minimum Nominal Thickness: 10 mil DFT.
 - a. Comply with manufacturer's recommended coverage rates for conditions encountered.
 - 4. Provide complete cover with recommended coating system.
- D. For concrete exposed to view anywhere within the Clean Zone boundaries fill concrete voids, bugholes, and other cavities with paint system Manufacturer's recommended filler/sealer.
 - 1. Criteria definitions for voids, bugholes, and cavities shall be as provided by the finish manufacturer's written documentation.
- E. Obtain architect's approval of finish for surfaces to receive high build glazed coatings.

3.10 APPLICATION - GENERAL

- A. Paint surfaces as specified in paragraphs "Schedule - Interior Paint Systems".
- B. Provide complete coverage and hide.
 - 1. Paint systems are to cover.
 - 2. When color or undercoats show through, apply additional coats at no additional cost until paint film is of uniform finish and color.
- C. Employ only skilled mechanics.
- D. Mix and apply as recommended by manufacturer.
- E. If Architect so directs, do not apply succeeding coats until Architect has an opportunity to observe previous coat.
- F. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
- G. Upon completion of painting, carefully replace removed items and/or remove protection.
- H. Apply materials under adequate illumination.
- I. Evenly spread and smoothly flow on for full, smooth cover.
- J. Assure that coats are dry before recoating.
- K. Touch up suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- L. Touch up abraded areas of shop prime coats before subsequent coats are applied.
- M. Back prime wood trim with penetrating sealer.

3.11 APPLICATION - INTERIOR

- A. Finish door edges same as faces of doors.
- B. Finish closets, semi-exposed surfaces behind grilles, radiation, etc., to match nearest adjoining surfaces.

3.12 PROTECTION AND CLEANUP

- A. Protect adjacent work against damage by painting and finishing work.
- B. Clean, repair or replace, and repaint damaged work as directed by Architect.
- C. Provide "WET PAINT" signs.
- D. Remove temporary protective wrappings, after completion of operations.
- E. Clean paint spattered surfaces.
- F. Use care not to damage finished surfaces.
- G. Remove surplus materials, scaffolding and debris.
- H. Leave areas broom clean.

3.13 SCHEDULE - INTERIOR PAINT SYSTEMS

- A. Concrete and concrete block walls:
 - a. Glidden Professional:
 - 1) Primer coat: 9116 Lifemaster No VOC Primer.
 - 2) Intermediate coat: Lifemaster No VOC Eggshell Interior;
 - 3) Topcoat: Lifemaster No VOC Eggshell Interior.
- B. Gypsum wallboard walls:
 - 1. Low Odor (PNTLO), Gloss Level 3 (Eggshell):
 - a. Glidden Professional:
 - 1) Primer coat: 9116 Lifemaster No VOC Primer.
 - 2) Intermediate coat: Lifemaster No VOC Eggshell Interior;
 - 3) Topcoat: Lifemaster No VOC Eggshell Interior.
- C. Gypsum wallboard ceiling:
 - 1. Low Odor (PNTLO), Gloss Level 1 (Flat):
 - a. Glidden Professional:
 - 1) Primer coat: 9116 Lifemaster No VOC Primer.
 - 2) Intermediate coat: Lifemaster No VOC Eggshell Interior;
 - 3) Topcoat: Lifemaster No VOC Eggshell Interior.
- D. Metal stairs, handrails, and guardrails and miscellaneous metals (ferrous, primed, zinc-coated, and aluminum):
 - 1. Water based urethane, Gloss Level 6 (Gloss):
 - a. Sherwin Williams:
 - 1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
 - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - b. PPG:
 - 1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
 - 2) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
 - 3) Topcoat: Durethane WB Water Based Urethane; 98-8200.
- E. Metal doors and frames:
 - 1. Waterborne acrylic, Gloss Level 5 (Semi gloss):
 - a. Sherwin Williams:
 - 1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
 - 2) Intermediate coat: Pro Classic Waterborne Acrylic Semi-Gloss, B31 Series.
 - 3) Topcoat: Pro Classic Waterborne Acrylic Semi-Gloss, B31 Series.
 - b. PPG:
 - 1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
 - 2) Intermediate coat: Acrylic Metal Finish S/G; 7-374.
 - 3) Topcoat: Acrylic Metal Finish S/G; 7-374.

- F. Structural steel (primed in Section 05 12 10):
 - 1. Water based urethane, Gloss Level 6 (Gloss):
 - a. Sherwin Williams:
 - 1) Primer coat: Shop-applied product specified elsewhere.
 - a) Touch-up in field as required.
 - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
 - b. PPG:
 - 1) Primer coat: Shop-applied product specified elsewhere.
 - a) Touch-up in field as required.
 - 2) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
 - 3) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
 - 4) Topcoat: Durethane WB Water Based Urethane; 98-8200.
- G. Wood:
 - 1. Exposed items, Gloss Level 3 (Eggshell):
 - a. Glidden Professional:
 - 1) Primer coat: 9116 Lifemaster No VOC Primer.
 - 2) Intermediate coat: Lifemaster No VOC Eggshell Interior;
 - 3) Topcoat: Lifemaster No VOC Eggshell Interior.
 - 2. Concealed items, Gloss Level 3 (Eggshell):
 - a. Glidden Professional:
 - 1) Primer coat: Ultra-Hide Interior Primer; 1030.
 - 2) Intermediate coat: Pro Premium Eggshell Interior Wall & Trim Enamel; 1402.
 - 3) Topcoat: Pro Premium Eggshell Interior Wall & Trim Enamel; 1402.

3.14 SCHEDULE – FIELD NATURAL FINISH SYSTEM FOR INTERIOR WOOD

- A. General:
 - 1. Factory finishing of wood items specified elsewhere:
 - a. Factory finishing of wood veneer-faced casework: Specified in Section 12 34 00.
 - b. Factory finishing of wood veneer-faced wood doors: Specified in Section 08 14 16.
- B. Interior Wood
 - 1. Washcoat: Prepare wood to accept stain uniformly by application of a washcoat.
 - a. Sherwin Williams.
 - 1) Wood Classics Natural.
 - b. Glidden Professional:
 - 1) Woodpride.
 - c. PPG:
 - 1) Olympic Wood Conditioner; 41001.
 - 2. Wood Stain:
 - a. Sherwin Williams:
 - 1) Wood Classics Oil Stain, A49V200.
 - b. Glidden Professional:
 - 1) Woodpride Oil Based Stain; 1700 series.
 - c. PPG:
 - 1) Rez Interior Oil Stain; 77-560.
 - 3. Filler Coat (horizontal surfaces where open-grained wood is indicated): Exception: Omit filler coat at closed grained wood specie.
 - a. Sherwin Williams:
 - 1) SherWood Natural Filler, D70T1.
 - b. PPG:
 - 1) Olympic Wood Filler; 41003.
 - 4. Sanding Sealer:
 - a. Sherwin Williams:
 - 1) Wood Classics FastDry Sanding Sealer, B26.
 - b. ICI:

- 1) Woodpride 1800 or 1900 series thinned 25 percent.
- c. PPG:
 - 1) Speedhide Interior Oil Sanding Sealer; 6-10.
 - 2) Selected polyurethane varnish thinned 25 percent.
5. Clear Topcoat:
 - a. Quality Assurance: 8th Edition, Version 2.0 (or more current) of “Architectural Woodwork Quality Standards” by AWI and AWMAC.
 - 1) Comply with Section 1500; Premium Quality.
 - 2) Comply with Section 1500; Custom Quality
 - b. Sheen (measured with 60 degree gloss meter):
 - 1) Flat; 15 to 30 points.
 - 2) Satin: 31 to 45 points.
 - 3) Semi-gloss: 46 to 60 points.
 - 4) Gloss: greater than 61 points.
 - c. Apply following product in at least 2 coats.
 - 1) Lightly scuff sand in between coats.
6. Water-based Polyurethane Varnish (non-yellowing):
 - a. Sherwin Williams:
 - 1) Wood Classics Waterborne Polyurethane Varnish; A68.
 - b. ICI:
 - 1) Woodpride Waterbased Varnish; 1800 series.
 - c. PPG:
 - 1) Rez Interior Water Based Varnish; 77-45 (Gloss) or 77-49 (Satin).

END OF SECTION

SECTION 10 11 00
MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.1 SUBMITTALS

AD-4: Section 10 11 00: Added paragraph 1.1.A.

- A. Samples:
 - 1. 8 IN x 10 IN samples of sheet materials.
- B. Contract closeout information:
 - 1. Maintenance data.
 - 2. Warranty.
- C. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Manufacturers' product data for each composite wood product used indicating that the bonding agent used contains no urea formaldehyde

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver completely assembled whenever possible.
- B. Where dimensions exceed available panel size, provide 2 or more pieces of length acceptable to Architect.
- C. When dimensions require delivery in separate units, prefit at factory, disassemble for delivery, and make final joint at site.
- D. Provide all required packing and unpacking at site.

1.3 WARRANTY

- A. Lifetime warranty against fading, crazing, cracking and delamination for markerboards.
- B. Warranty signed jointly by manufacturer and Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Markerboards and Tackboards:
 - a. Base: Claridge Products & Equipment.
 - b. Optional: ADP Lemco.
 - 2. Furnish all Markerboards and tackboards by one manufacturer for entire project.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

-
- B. Markerboard, metal (MB):
1. Balanced, high pressure laminated, 3-ply laminated construction, with facing sheet, core, and backer.
 2. Finish:
 - a. Type A porcelain enamel over ground coat on writing surface with seal coat on reverse side.
 - b. Comply with Porcelain Enamel Institute Specifications.
 3. Face sheet:
 - a. Enameling steel, minimum 22 GA.
 - b. Finish to accommodate dry and liquid markers without residual staining.
 4. Core: Minimum 1/4 IN thick plywood or hardboard.
 5. Backer: Minimum 26 GA zinc plated steel, 28 GA random porcelain coil, or 0.015 IN aluminum sheet.
 6. Backing panel: Moisture resistant formaldehyde free plywood or hardboard 1/4 IN thick, with 1/4 IN backing; or, may be one piece 1/2 IN thick.

AD-4: Section 10 11 00: Added paragraph 2.1.C.

- C. Tackboards, plastic impregnated cork (TBP):
1. Seamless sheet, 1/4 IN thick with washable vinyl finish.
 2. Ground natural cork compressed with integral color throughout.
 3. Laminated to burlap backing.
 4. Provide one 48"H x 72"W tackboard at each C/P/F room. Consult Architect for final location and height within room.
- D. Frames and trim:
1. Minimum 0.062 IN thick aluminum.
 2. All markerboards 42"X 30".
 3. Single length units to minimize joints.
 4. Miter all corners to a neat, hairline closure.
 5. Satin anodized finish, AA-M30C22A31.
 6. Manufacturer's standard "narrow" trim, approximately 1/2 IN wide.
 7. When structural support accessories are required for boards in addition to normal trim, provide such additional support or modify trim as required to provide necessary support.
- E. Troughs:
1. Continuous, for each board.
 2. Box type, with slanted front and cast aluminum end closures.
- F. Display rail, install at top of each unit with:
1. Continuous 2 IN with integral cork strip.
 2. End stops: One at each end.
 3. Display hooks: One per 2 FT of rail.
 4. Display hooks with flexible metal clips: 1 per 2 FT of display rail or fraction thereof.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate Wall Backing has been installed.
1. Metal Wall Backing: Specified in Section 09 22 16.
 2. Coordinate and direct installation of backing where required.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Provide trim at joints between Markerboards and Tackboards.
- B. Trim out vertical joints with aluminum H type divider bars.
- C. Provide additional backing as indicated or necessary to properly stiffen and support boards.
- D. Install at locations and heights indicated in accordance with manufacturer's instructions.
- E. Install with concealed hangers, plumb and level.
- F. Coordinate job assembled units with grounds, trim, and accessories.
- G. Join all parts with neat, precision fit.
- H. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations.
- I. Install with bottom 3'-6" AFF unless indicated otherwise.
- J. Protect after installation until accepted by Laboratory.

END OF SECTION

SECTION 10 14 00
IDENTIFICATION DEVICES (Revised AD-4)

PART 1 - PART 1 GENERAL

1.1 SECTION INCLUDES

- a. Interior signs.

1.2 SUBMITTALS: FOLLOW SECTION 01 33 00.

- a. Shop Drawings: Provide detailed shop drawings on minimum 11 x 17" sheets. Shop drawings shall provide materials and dimensions for each sign type. Method of manufacture should be described for all sign types.
- b. Samples (Interior Signs): Provide one full size sample of sign type RM-C1.

PART 2 - PART 2 PRODUCTS

A. SIGN MANUFACTURERS:

- a. Takeform Architectural Graphics. One Mahor Way, Medina, NY 14103. 1-800-528-1398. Product – Quad Fusion 06 Signage System.
- b. Poblocki. Contact: Scott Muller. 922 South 70th Street, Milwaukee, WI 53214. www.poblocki.com. Product: Custom Signage to match Takeform Product above.
- c. APCO Signs. Contact: Ken Mettler. 225 Ashcroft Lane. Oswego, IL 60543. www.apcosigns.com. Product: Custom Signage to match Takeform Product above.
- d. ASI Signage. Contact: Ed Evans. 2650-C West Bradley Place, Chicago, IL 60618. 610-987-0681. www.asisignage.com. Product: Custom Signage to match Takeform Product above.

B. MATERIALS

- a. Interior Signs: A rigid subsurface material with Wilsonart and Nevamar laminate faces as prescribed in drawing sheets AG-501 and AG-502. Tactile letters and Grade 2 Braille. Non-glare acrylic lenses on window signs. Additional information can be found on drawing sheets listed above.
- b. Face Color: See drawings AG-501 and AG-502.

C. LETTERING

- a. Size and Style: See drawings AG-501 and AG-502.
- b. Colors: See drawings AG-501 and AG-502.

D. ACCESSORIES

- a. Mounting Hardware: VHB tape for mounting signs unless weight of a sign dictates use of mechanical fasteners.

E. SIGN TYPE SS-1

- a. Sign Type SS – 1, Sconce Sign, is an illuminated light sconce that will be mounted next to Laboratory doors and will incorporate the room number in tactile and Braille. The sconce cover will be fabricated from a 3form substrate. The 3form material will be shipped to the sign manufacturer for installation of the raster Braille and tactile letters. The sign manufacturer will then ship the material back to the lighting manufacturer. The finished Sconce Sign will be installed by the lighting installers.

2.06 ATTIC STOCK

- A. In addition to the signs listed in the message schedule, please provide the following
 - a. Sign Type RM-C1: 12 additional signs with no tactile/Braille
 - b. Sign Type LS-1: 6 additional signs
 - c. Sign Type CR-1: 6 additional signs

PART 3 - PART 3 EXECUTION

1. SIGN INSTALLATION
 - a. Install work in accordance with ADAAG, ANSI Standards and Illinois barrier free regulations.
 - b. Install signs after doors and surfaces are finished, in locations scheduled.
 - c. Locate room signs 3" from door frame, with top of sign 60" AFF.
 - d. Location of LS-1 signs: refer to A-400 series sheets.
 - e. For signs mounted on glass, install same-size vinyl backer on opposite side of glass to obscure back of sign.
 - f. Clean and polish.
2. SIGN LOCATIONS
 - a. See Specification section 10 14 00 for Signage Message Schedule. Sign locations are all keyed to door numbers.

END OF SECTION

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES	
GROUND	A006	ST-1 LV-1		STAIR A STAIR A FLOOR G THRU P G FLOOR ROOF ACCESS FLOOR 1 TO EXIT	MOUNT IN CORRIDOR MOUNT IN STAIR TOWER
GROUND	A007	RM-C1	A007	STORAGE	
GROUND	A008	RM-P1	A008	ELECTRICAL	
GROUND	A010	SS-1 + LS-1	A010	(TBD)	LAB
GROUND	A010A	RM-C1 + LS-1	A010	(TBD)	LAB
GROUND	A012	SS-1 + LS-1	A012	(TBD)	LAB
GROUND	A012A	RM-C1 + LS-1	A012	(TBD)	LAB
GROUND	A013	SS-1 + LS-1	A013	(TBD)	LAB
GROUND	A013A	RM-C1 + LS-1	A013	(TBD)	LAB
GROUND	A016	SS-1 + LS-1	A016	(TBD)	LAB
GROUND	A016A	RM-C1 + LS-1	A016	(TBD)	LAB
GROUND	A019	SS-1 + LS-1	A019	(TBD)	LAB
GROUND	A019A	RM-C1 + LS-1	A019	(TBD)	LAB
GROUND	A021	SS-1 + LS-1	A021	(TBD)	LAB
GROUND	A021A	RM-C1 + LS-1	A021	(TBD)	LAB
GROUND	A023	SS-1 + LS-1	A023	(TBD)	LAB
GROUND	A023A	RM-C1 + LS-1	A023	(TBD)	LAB
GROUND	A024	SS-1 + LS-1	A024	(TBD)	LAB
GROUND	A024A	RM-C1 + LS-1	A024	(TBD)	LAB
GROUND	A025	SS-1 + LS-1	A025	(TBD)	LAB
GROUND	A025A	RM-C1 + LS-1	A025	(TBD)	LAB
GROUND	A026	SS-1 + LS-1	A026	ELECTRICAL	
GROUND	A027	SS-1 + LS-1	A027	(TBD)	LAB
GROUND	A027A	RM-C1 + LS-1	A027	(TBD)	LAB
GROUND	A028	SS-1 + LS-1	A028	(TBD)	LAB - Alternate 2 Only
GROUND	A028A	RM-C1 + LS-1	A028	(TBD)	LAB - Alternate 2 Only
GROUND	A029	SS-1 + LS-1	A029	(TBD)	LAB
GROUND	A029A	RM-C1 + LS-1	A029	(TBD)	LAB
GROUND	A034	RM-P1	A034	ELECTRICAL	
GROUND	A062	RM-P1	A062	MECHANICAL	
GROUND	A063	RM-C1	A063	STORAGE	
GROUND	A063A	RM-C1	A063	STORAGE	
GROUND	A066	CR-1	A066	CONFERENCE	
GROUND	A067	RM-C1	A067	(TBD)	OFFICE
GROUND	A070	RM-C1	A070	(TBD)	OFFICE
GROUND	B010	SS-1 + LS-1	B010	(TBD)	LAB
GROUND	B010A	RM-C1 + LS-1	B010	(TBD)	LAB
GROUND	B010B	RM-C1 + LS-1	B010	(TBD)	LAB

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
GROUND	B010C	RM-C1 + LS-1	B010 (TBD)	LAB
GROUND	B016	SS-1 + LS-1	B016 (TBD)	LAB
GROUND	B016A	RM-C1 + LS-1	B016 (TBD)	LAB
GROUND	B018	SS-1 + LS-1	B018 (TBD)	LAB
GROUND	B018A	RM-C1 + LS-1	B018 (TBD)	LAB
GROUND	B020	RM-P1	B020 TELECOM	
GROUND	B023	SS-1 + LS-1	B023 (TBD)	LAB
GROUND	B023A	RM-C1 + LS-1	B023 (TBD)	LAB
GROUND	B027	SS-1 + LS-1	B027 (TBD)	LAB
GROUND	B027A	RM-C1 + LS-1	B027 (TBD)	LAB
GROUND	B027B	RM-C1 + LS-1	B027 (TBD)	LAB
GROUND	B031	SS-1 + LS-1	B031 (TBD)	LAB - Alternate 2 Only
GROUND	B031A	RM-C1 + LS-1	B031 (TBD)	LAB - Alternate 2 Only
GROUND	B061	RM-C1	B061 (TBD)	OFFICE
GROUND	B064	RM-C1	B064 (TBD)	OFFICE
GROUND	B067	RM-C1	B067 (TBD)	OFFICE
GROUND	B070	RM-C1	B070 (TBD)	OFFICE
GROUND	B071	RM-C1	B071 COPY ROOM	
GROUND	B074	TR-1	WOMEN	FEMALE PICTOGRAM
GROUND	B075	TR-1	MEN	MALE PICTOGRAM
GROUND	B076	RM-C1	B076 BREAK	
GROUND	B079	RM-P1	B079 JANITOR CLOSET	
GROUND	B080	ST-1	STAIR B	MOUNT IN CORRIDOR
		LV-1	STAIR B	MOUNT IN STAIR TOWER
			FLOOR G THRU P	
			G	
			FLOOR	
			ROOF ACCESS	
			EXIT THIS FLOOR	
GROUND	B080A	ST-1	STAIR B	MOUNT IN CORRIDOR
		LV-1	STAIR B	MOUNT IN STAIR TOWER
			FLOOR G THRU P	
			G	
			FLOOR	
			ROOF ACCESS	
			EXIT THIS FLOOR	
GROUND	C009	RM-C1	C009 SERVICE CORE	
GROUND	C009A	RM-C1	C009 SERVICE CORE	
GROUND	C023	RM-C1	C023 SERVICE CORE	
GROUND	C023A	RM-C1	C023 SERVICE CORE	
GROUND	C027	RM-C1	C027 SERVICE CORE	
GROUND	C027A	RM-C1	C027 SERVICE CORE	
GROUND	D069	RM-P1	D069 MECHANICAL	
GROUND	D069A	RM-P1	D069 MECHANICAL	
GROUND	D071	RM-P1	D071 MECHANICAL	

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
GROUND	D071A	RM-P1	D071	MECHANICAL
GROUND	D076	RM-P1	D076	ELECTRICAL EMERGENCY
GROUND	D076A	RM-P1	D076	ELECTRICAL EMERGENCY
GROUND	D077	RM-P1	D077	ELECTRICAL EMERGENCY
GROUND	D077A	RM-P1	D077	ELECTRICAL EMERGENCY
GROUND	D079	RM-P1	D079	ELECTRICAL
GROUND	D082	RM-P1	D082	HAZARDOUS STORAGE
GROUND	D083	RM-P1	D083	HAZARDOUS STORAGE

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
FIRST	A106	ST-1	STAIR A	MOUNT IN CORRIDOR
		LV-1	STAIR A	MOUNT IN STAIR TOWER
			FLOOR G THRU P 1	
			FLOOR ROOF ACCESS EXIT THIS FLOOR	
FIRST	A106A	ST-1	STAIR A	MOUNT IN CORRIDOR
		LV-1	STAIR A	MOUNT IN STAIR TOWER
			FLOOR G THRU P 1	
			FLOOR ROOF ACCESS EXIT THIS FLOOR	
FIRST	A108	RM-P1	A108	ELECTRICAL
FIRST	A110	SS-1 + LS-1	A110	(TBD) LAB
FIRST	A110A	RM-C1 + LS-1	A110	(TBD) LAB
FIRST	A113	SS-1 + LS-1	A113	(TBD) LAB
FIRST	A113A	RM-C1 + LS-1	A113	(TBD) LAB
FIRST	A113B	RM-C1 + LS-1	A113	(TBD) LAB
FIRST	A113C	RM-C1 + LS-1	A113	(TBD) LAB
FIRST	A118	SS-1 + LS-1	A118	(TBD) LAB
FIRST	A118A	RM-C1 + LS-1	A118	(TBD) LAB
FIRST	A120	RM-P1	A120	TELECOM
FIRST	A126	RM-P1	A126	ELECTRICAL
FIRST	A127	RM-C1 + LS-1	A127	(TBD) LAB
FIRST	A127A	RM-C1 + LS-1	A127	(TBD) LAB
FIRST	A128	RM-C1 + LS-1	C128	(TBD) LAB
FIRST	A129	RM-C1 + LS-1	A129	(TBD) LAB
FIRST	A129A	RM-C1 + LS-1	A129	(TBD) LAB
FIRST	A134	RM-P1	A134	ELECTRICAL
FIRST	A160	RM-C1	A160	(TBD) OFFICE

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
FIRST	A163	RM-C1	A163 (TBD)	OFFICE
FIRST	A164	RM-C1	A164 (TBD)	OFFICE
FIRST	A166	RM-C1	A166 (TBD)	OFFICE
FIRST	A167	RM-C1	A167 (TBD)	OFFICE
FIRST	A170	RM-C1	A170 (TBD)	OFFICE
FIRST	A177	RM-C1	A177 (TBD)	OFFICE
FIRST	A179	RM-C1	A179 (TBD)	OFFICE
FIRST	A180	RM-C1	A180 (TBD)	OFFICE
FIRST	A182	RM-C1	A182 (TBD)	OFFICE - Alternate 2 Only
FIRST	B110	SS-1 + LS-1	B110 (TBD)	LAB
FIRST	B110A	RM-C1 + LS-1	B110 (TBD)	LAB
FIRST	B110B	RM-C1 + LS-1	B110 (TBD)	LAB
FIRST	B110C	RM-C1 + LS-1	B110 (TBD)	LAB
FIRST	B117	SS-1 + LS-1	B117 (TBD)	LAB
FIRST	B117A	RM-C1 + LS-1	B117 (TBD)	LAB
FIRST	B123	CR-1	B123 CONFERENCE	
FIRST	B127	SS-1 + LS-1	B127 (TBD)	LAB - Alternate 2 Only
FIRST	B127A	RM-C1 + LS-1	B127 (TBD)	LAB - Alternate 2 Only
FIRST	B129	SS-1 + LS-1	B129 (TBD)	LAB - Alternate 2 Only
FIRST	B129A	RM-C1 + LS-1	B129 (TBD)	LAB - Alternate 2 Only
FIRST	B129B	RM-C1 + LS-1	B129 (TBD)	LAB - Alternate 2 Only
FIRST	B129C	RM-C1 + LS-1	B129 (TBD)	LAB - Alternate 2 Only
FIRST	B161	RM-C1	B161 (TBD)	OFFICE
FIRST	B164	RM-C1	B164 (TBD)	OFFICE
FIRST	B167	RM-C1	B167 (TBD)	OFFICE
FIRST	B170	RM-C1	B170 (TBD)	OFFICE
FIRST	B171	RM-C1	B171 COPY ROOM	
FIRST	B174	TR-1	B174 WOMEN	FEMALE PICTOGRAM
FIRST	B175	TR-1	B175 MEN	MALE PICTOGRAM
FIRST	B176	RM-P1	B176 JANITOR CLOSET	
FIRST	B177	RM-C1	B177 BREAK	
FIRST	B180	ST-1	STAIR B	MOUNT IN CORRIDOR
		LV-1	STAIR B	MOUNT IN STAIR TOWER
			FLOOR G THRU P 1 FLOOR ROOF ACCESS FLOOR G TO EXIT	
FIRST	B183	RM-C1	B183 (TBD)	OFFICE - Alternate 2 Only
FIRST	B184	CR-1	B184 CONFERENCE	Alternate 2 Only
FIRST	C109	RM-C1	C109 SERVICE CORE	
FIRST	C109A	RM-C1	C109 SERVICE CORE	
FIRST	C127	RM-C1	C127 SERVICE CORE	
FIRST	C127A	RM-C1	C127 SERVICE CORE	
FIRST	C128A	RM-C1 + LS-1	C128 (TBD)	LAB

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
SECOND	A206	ST-1 LV-1	STAIR A STAIR A FLOOR G THRU P 2 FLOOR ROOF ACCESS FLOOR 1 TO EXIT	MOUNT IN CORRIDOR MOUNT IN STAIR TOWER
SECOND	A208	RM-P1	A208	ELECTRICAL
SECOND	A210	SS-1 + LS-1	A210	(TBD) LAB
SECOND	A210A	RM-C1 + LS-1	A210	(TBD) LAB
SECOND	A213	SS-1 + LS-1	A213	(TBD) LAB
SECOND	A213A	RM-C1 + LS-1	A213	(TBD) LAB
SECOND	A216	SS-1 + LS-1	A216	(TBD) LAB
SECOND	A216A	RM-C1 + LS-1	A216	(TBD) LAB
SECOND	A216B	RM-C1 + LS-1	A216	(TBD) LAB
SECOND	A216C	RM-C1 + LS-1	A216	(TBD) LAB
SECOND	A221	SS-1 + LS-1	A221	(TBD) LAB
SECOND	A221A	RM-C1 + LS-1	A221	(TBD) LAB
SECOND	A226	RM-P1	A226	ELECTRICAL
SECOND	A227	SS-1 + LS-1	A227	(TBD) LAB
SECOND	A227A	RM-C1 + LS-1	A227	(TBD) LAB
SECOND	A229	SS-1 + LS-1	A229	(TBD) LAB
SECOND	A229A	RM-C1 + LS-1	A229	(TBD) LAB
SECOND	A231	SS-1 + LS-1	A231	(TBD) LAB - Alternate 2 Only
SECOND	A231A	RM-C1 + LS-1	A231	(TBD) LAB - Alternate 2 Only
SECOND	A234	RM-P1	A234	ELECTRICAL
SECOND	A254	RM-C1	A254	VESTIBULE
SECOND	A254A	RM-C1	A254	VESTIBULE
SECOND	A255	CR-1	A255	CONFERENCE
SECOND	A257	RM-C1	A257	(TBD) OFFICE
SECOND	A258	RM-C1	A258	(TBD) OFFICE
SECOND	A260	RM-C1	A260	(TBD) OFFICE
SECOND	A261	RM-C1	A261	(TBD) OFFICE
SECOND	A263	RM-C1	A263	(TBD) OFFICE
SECOND	A264	RM-C1	A264	(TBD) OFFICE
SECOND	A266	RM-C1	A266	(TBD) OFFICE
SECOND	A267	RM-C1	A267	(TBD) OFFICE
SECOND	A269	RM-C1	A269	(TBD) OFFICE
SECOND	A270	RM-C1	A270	(TBD) OFFICE
SECOND	A272	RM-C1	A272	(TBD) OFFICE
SECOND	A275	RM-C1	A275	(TBD) OFFICE
SECOND	A277	RM-C1	A277	(TBD) OFFICE
SECOND	A278	RM-C1	A278	(TBD) OFFICE
SECOND	A280	RM-C1	A280	(TBD) OFFICE
SECOND	A281	RM-C1	A281	(TBD) OFFICE

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
SECOND	A283	RM-C1	A283 (TBD)	OFFICE - Alternate 2 Only
SECOND	A284	RM-C1	A284 (TBD)	OFFICE - Alternate 2 Only
SECOND	A285	CR-1	A285 CONFERENCE	
SECOND	B210	SS-1 + LS-1	B210 (TBD)	LAB
SECOND	B210A	RM-C1 + LS-1	B210 (TBD)	LAB
SECOND	B212	SS-1 + LS-1	B212 (TBD)	LAB
SECOND	B212A	RM-C1 + LS-1	B212 (TBD)	LAB
SECOND	B214	SS-1 + LS-1	B214 (TBD)	LAB
SECOND	B214A	RM-C1 + LS-1	B214 (TBD)	LAB
SECOND	B216	SS-1 + LS-1	B216 (TBD)	LAB
SECOND	B216A	RM-C1 + LS-1	B216 (TBD)	LAB
SECOND	B218	SS-1 + LS-1	B218 (TBD)	LAB
SECOND	B218A	RM-C1 + LS-1	B218 (TBD)	LAB
SECOND	B220	RM-P1	B220 TELECOM	
SECOND	B227	SS-1 + LS-1	B227 (TBD)	LAB
SECOND	B227A	RM-C1 + LS-1	B227 (TBD)	LAB
SECOND	B228	SS-1 + LS-1	B228 (TBD)	LAB - Alternate 2 Only
SECOND	B228A	RM-C1 + LS-1	B228 (TBD)	LAB - Alternate 2 Only
SECOND	B229	SS-1 + LS-1	B229 (TBD)	LAB
SECOND	B229A	RM-C1 + LS-1	B229 (TBD)	LAB
SECOND	B256	RM-C1	B256 (TBD)	OFFICE
SECOND	B257	RM-C1	B257 (TBD)	OFFICE
SECOND	B258	RM-C1	B258 (TBD)	OFFICE
SECOND	B260	RM-C1	B260 COPY ROOM	
SECOND	B261	RM-C1	B261 (TBD)	OFFICE
SECOND	B264	RM-C1	B264 (TBD)	OFFICE
SECOND	B265	RM-C1	B265 (TBD)	OFFICE
SECOND	B267	RM-C1	B267 (TBD)	OFFICE
SECOND	B268	RM-C1	B268 (TBD)	OFFICE
SECOND	B270	RM-C1	B270 (TBD)	OFFICE
SECOND	B271	RM-C1	B271 (TBD)	OFFICE
SECOND	B274	TR-1	WOMEN	FEMALE PICTOGRAM
SECOND	B275	TR-1	MEN	MALE PICTOGRAM
SECOND	B276	RM-P1	B276 JANITOR CLOSET	
SECOND	B277	RM-C1	B277 COPY ROOM	
SECOND	B278	RM-C1	B278 (TBD)	OFFICE
SECOND	B280	ST-1	STAIR B	MOUNT IN CORRIDOR
		LV-1	STAIR B	MOUNT IN STAIR TOWER
			FLOOR G THRU P 2 FLOOR ROOF ACCESS FLOOR G TO EXIT	
SECOND	B283	RM-C1	B283 (TBD)	OFFICE - Alternate 2 Only
SECOND	B284	RM-C1	B284 (TBD)	OFFICE - Alternate 2 Only

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE		NOTES
SECOND	B285	CR-1	B285	CONFERENCE	Alternate 2 Only
SECOND	C209	RM-C1	C209	SERVICE CORE	
SECOND	C209A	RM-C1	C209	SERVICE CORE	
SECOND	C227	RM-C1	C227	SERVICE CORE	
SECOND	C227A	RM-C1	C227	SERVICE CORE	

NOTE: NOT FOR CONSTRUCTION - CONFIRM ALL ROOM NAMES WITH CLIENT PRIOR TO MANUFACTURING

LEVEL	DOOR NUMBER	SIGN TYPE(S)	MESSAGE	NOTES
THIRD	A306	ST-1 LV-1	STAIR A STAIR A FLOOR G THRU P 3 FLOOR ROOF ACCESS FLOOR 1 TO EXIT	MOUNT IN CORRIDOR MOUNT IN STAIR TOWER
THIRD	A308	RM-P1	A308	ELECTRICAL
THIRD	A310	SS-1 + LS-1	A310	(TBD) LAB
THIRD	A310A	RM-C1 + LS-1	A310	(TBD) LAB
THIRD	A313	SS-1 + LS-1	A313	(TBD) LAB
THIRD	A313A	RM-C1 + LS-1	A313	(TBD) LAB
THIRD	A313B	RM-C1 + LS-1	A313	(TBD) LAB
THIRD	A316	SS-1 + LS-1	A316	(TBD) LAB
THIRD	A316A	RM-C1 + LS-1	A316	(TBD) LAB
THIRD	A319	SS-1 + LS-1	A319	(TBD) LAB
THIRD	A319A	RM-C1 + LS-1	A319	(TBD) LAB
THIRD	A323	CR-1	A323	CONFERENCE
THIRD	A323A	CR-1	A323	CONFERENCE
THIRD	A326	RM-P1	A326	ELECTRICAL
THIRD	A327	SS-1 + LS-1	A327	(TBD) LAB
THIRD	A327A	RM-C1 + LS-1	A327	(TBD) LAB
THIRD	A329	SS-1 + LS-1	A329	(TBD) LAB - Alternate 2 Only
THIRD	A329A	RM-C1 + LS-1	A329	(TBD) LAB - Alternate 2 Only
THIRD	A330	SS-1 + LS-1	A330	(TBD) LAB - Alternate 2 Only
THIRD	A330A	RM-C1 + LS-1	A330	(TBD) LAB - Alternate 2 Only
THIRD	A332	SS-1 + LS-1	A332	(TBD) LAB - Alternate 2 Only
THIRD	A332A	RM-C1 + LS-1	A332	(TBD) LAB - Alternate 2 Only
THIRD	A334	RM-P1	A334	ELECTRICAL
THIRD	A354	RM-C1	A354	(TBD) ASSOC. LAB DIRECTOR
THIRD	A355	RM-C1	A355	(TBD) ESH
THIRD	A356	CR-1	A356	CONFERENCE
THIRD	A357	RM-C1	A357	(TBD) OFFICE
THIRD	A358	RM-C1	A358	(TBD) OFFICE
THIRD	A360	RM-C1	A360	(TBD) OFFICE
THIRD	A361	RM-C1	A361	(TBD) OFFICE
THIRD	A363	RM-C1	A363	(TBD) OFFICE
THIRD	A364	RM-C1	A364	(TBD) OFFICE
THIRD	A366	RM-C1	A366	(TBD) OFFICE
THIRD	A367	RM-C1	A367	(TBD) OFFICE
THIRD	A369	RM-C1	A369	(TBD) OFFICE
THIRD	A370	RM-C1	A370	(TBD) OFFICE
THIRD	A372	RM-C1	A372	(TBD) OFFICE
THIRD	A375	RM-C1	A375	(TBD) OFFICE
THIRD	A377	RM-C1	A377	(TBD) OFFICE - Alternate 2 Only

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	
THIRD	A378	RM-C1	A378	(TBD) OFFICE - Alternate 2 Only
THIRD	A380	RM-C1	A380	(TBD) OFFICE - Alternate 2 Only
THIRD	A381	RM-C1	A381	(TBD) OFFICE - Alternate 2 Only
THIRD	A383	RM-C1	A383	(TBD) OFFICE - Alternate 2 Only
THIRD	A384	RM-C1	A384	(TBD) OFFICE - Alternate 2 Only
THIRD	A385	CR-1	A385	CONFERENCE Alternate 2 Only
THIRD	B310	SS-1 + LS-1	B310	(TBD) LAB
THIRD	B313	SS-1 + LS-1	B313	(TBD) LAB
THIRD	B313A	RM-C1 + LS-1	B313	(TBD) LAB
THIRD	B313B	RM-C1 + LS-1	B313	(TBD) LAB
THIRD	B313C	RM-C1 + LS-1	B313	(TBD) LAB
THIRD	B318	SS-1 + LS-1	B318	(TBD) LAB
THIRD	B318A	RM-C1 + LS-1	B318	(TBD) LAB
THIRD	B320	RM-P1	B320	TELECOM
THIRD	B327	SS-1 + LS-1	B327	(TBD) LAB - Alternate 2 Only
THIRD	B328	SS-1 + LS-1	B328	(TBD) LAB - Alternate 2 Only
THIRD	B328A	RM-C1 + LS-1	B328	(TBD) LAB - Alternate 2 Only
THIRD	B329	SS-1 + LS-1	B329	(TBD) LAB - Alternate 2 Only
THIRD	B329A	RM-C1 + LS-1	B329	(TBD) LAB - Alternate 2 Only
THIRD	B332	SS-1 + LS-1	B332	(TBD) LAB - Alternate 2 Only
THIRD	B332A	RM-C1 + LS-1	B332	(TBD) LAB - Alternate 2 Only
THIRD	B333	SS-1 + LS-1	B333	(TBD) LAB - Alternate 2 Only
THIRD	B333A	RM-C1 + LS-1	B333	(TBD) LAB - Alternate 2 Only
THIRD	B356	RM-C1	B356	(TBD) OFFICE
THIRD	B358	RM-C1	B358	(TBD) OFFICE
THIRD	B360	RM-C1	B360	COPY ROOM
THIRD	B361	RM-C1	B361	(TBD) OFFICE
THIRD	B364	RM-C1	B364	(TBD) OFFICE
THIRD	B365	RM-C1	B365	(TBD) OFFICE
THIRD	B367	RM-C1	B367	(TBD) OFFICE
THIRD	B368	RM-C1	B368	(TBD) OFFICE
THIRD	B370	RM-C1	B370	(TBD) OFFICE
THIRD	B371	RM-C1	B371	(TBD) OFFICE
THIRD	B374	TR-1		WOMEN
THIRD	B375	TR-1		MEN
THIRD	B376	RM-P1	B376	JANITOR CLOSET
THIRD	B377	RM-C1	B377	COPY ROOM
THIRD	B378	RM-C1	B378	(TBD) (TBD)
THIRD	B380	ST-1		STAIR B MOUNT IN CORRIDOR
		LV-1		STAIR A MOUNT IN STAIR TOWER
				FLOOR G THRU P
				3
				FLOOR
				ROOF ACCESS
				FLOOR G TO EXIT

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
THIRD	B384	CR-1	B384 CONFERENCE	Alternate 2 Only
THIRD	C305	RM-C1	C305 (TBD)	OPEN OFFICE
THIRD	C306	RM-C1	C306 (TBD)	
THIRD	C307	RM-C1	C307 COPY ROOM	
THIRD	C309	RM-C1	C309 SERVICE CORE	
THIRD	C309A	RM-C1	C309 SERVICE CORE	
THIRD	C327	RM-C1	C327 SERVICE CORE	
THIRD	C327A	RM-C1	C327 SERVICE CORE	
PENTHOUSE	A401	RM-P1	A401 PENTHOUSE	
PENTHOUSE	A421A	RM-P1	B421 ELEVATOR 1 EQUIPMENT	
PENTHOUSE	B419	RM-P1	B419 MECHANICAL	
PENTHOUSE	B427	RM-P1	B427 MECHANICAL	
PENTHOUSE	B480	ST-1	STAIR B	MOUNT IN CORRIDOR
		LV-1	STAIR A	MOUNT IN STAIR TOWER
			FLOOR G THRU P	
			P	
			FLOOR	
			ROOF ACCESS	
			FLOOR G TO EXIT	
PENTHOUSE	C402	ST-1	STAIR A	MOUNT IN CORRIDOR
		LV-1	STAIR A	MOUNT IN STAIR TOWER
			FLOOR G THRU P	
			P	
			FLOOR	
			ROOF ACCESS	
			FLOOR 1 TO EXIT	

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	NOTES
MEZZANINE	B523	RM-P1	B523 MEZZANINE	

NOTE: NOT FOR CONSTRUCTION - CONFIRM ALL ROOM NAMES WITH CLIENT PRIOR TO MANUFACTURING

SIGNAGE MESSAGE SCHEDULE - ALT 9 ONLY - ALL FLOORS

LEVEL DOOR NO. ROOM NO. ROOM NAME

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE	ROOM NAME	NOTES
FIRST	B177	RM-C1	B177	BREAK	
FIRST	B177A	RM-C1	B177	BREAK	
FIRST	D172	RM-C1	D172	SEMINAR	
FIRST	D172A	RM-C1	D172	SEMINAR	
FIRST	D172B	RM-C1	D172B	STORAGE	
FIRST	D172C	RM-C1	D172	SEMINAR	
FIRST	D173	RM-C1	D173	BREAKOUT	
FIRST	D173A	RM-C1	D173	BREAKOUT	
FIRST	D173B	RM-C1	D173	BREAKOUT	
FIRST	D175	RM-C1	D175	TBD	OPEN OFFICE
FIRST	D176	RM-C1	D176	TBD	OFFICE
FIRST	D177	RM-C1	D177	TBD	OFFICE
FIRST	D178	RM-C1	D178	TBD	OFFICE
FIRST	D179	RM-C1	D179	TBD	OFFICE
FIRST	D181	RM-C1	D181	TBD	OFFICE
FIRST	D182	RM-C1	D182	TBD	OFFICE
FIRST	D184	RM-C1	D184	TBD	OFFICE
SECOND	B273	RM-C1	B273	Copy Room	
SECOND	B276	RM-P1	B276	JANITOR CLOSET	
SECOND	B277	RM-C1	B277	BREAK	
SECOND	B278	RM-C1	B278	TBD	OFFICE
SECOND	B283	RM-C1	B283	CONFERENCE	
SECOND	B284	RM-C1	B284	TBD	OFFICE
SECOND	B285	RM-C1	B285	TBD	OFFICE
SECOND	D272	RM-C1	D272	TBD	OPEN OFFICE
SECOND	D272A	RM-C1	D272	TBD	OPEN OFFICE
SECOND	D274	RM-C1	D274	TBD	OFFICE
SECOND	D275	RM-C1	D275	TBD	OFFICE
SECOND	D276	RM-C1	D276	Copy Room	
SECOND	D277	RM-C1	D277	TBD	OFFICE
SECOND	D278	RM-C1	D278	TBD	OFFICE
SECOND	D279	RM-C1	D279	TBD	OFFICE
SECOND	D280	RM-C1	D280	TBD	OFFICE
SECOND	D281	RM-C1	D281	TBD	OFFICE
SECOND	D282	RM-C1	D282	TBD	OFFICE
SECOND	D283	RM-C1	D283	TBD	OFFICE
SECOND	D286	RM-C1	D286	CONFERENCE	
SECOND	D287	RM-C1	D287	TBD	OFFICE
SECOND	D288	RM-C1	D288	TBD	OFFICE
SECOND	D289	RM-C1	D289	TBD	OFFICE
SECOND	D290	RM-C1	D290	TBD	OFFICE

LEVEL	DOOR NUMBER	SIGN TYPE	MESSAGE		NOTES
SECOND	D291	RM-C1	D291	TBD	OFFICE
SECOND	D292	RM-C1	D292	TBD	OFFICE
SECOND	D293	RM-C1	D293	TBD	OFFICE
SECOND	D294	RM-C1	D294	TBD	OFFICE
SECOND	D295	RM-C1	D295	TBD	OFFICE

The Following Sign Locations are Deleted in Alt 9

FIRST B122
 FIRST B177

SECOND B277
 SECOND B278

SECTION 10 21 13
PLASTIC LAMINATE TOILET PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services required for fabrication and installation of Plastic Laminate Toilet Partitions as indicated in the drawings.
- B. Completely coordinate with work of other trades.
- C. Although such work is not specifically indicated, provide supplementary or miscellaneous items, appurtenances and devices incidental to, or necessary for a sound, secure and complete installation.

1.2 SUBMITTALS

- A. Shop Drawings.
- B. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Manufacturer's product data for each composite wood product used indicating that no urea formaldehyde is used in the production of the product.

1.3 WARRANTY

- A. Manufacturer shall warrant workmanship and materials for a period of 2 years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Toilet partitions:
 - 1. Base:
 - a. Bobrick Washroom Equipment.
 - 2. Optional:
 - a. All American Metal.
 - b. General Partitions Manufacturing Corp.
 - c. TexLam Manufacturing Inc.
 - d. Weis-Robart Partitions.
 - 3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MOUNTING CONFIGURATION

- A. Ceiling-hung.

2.3 PANEL MATERIALS

- A. General:
 - 1. Face and edging laminates:
 - a. Minimum NEMA GP50, 0.050 IN thick, high pressure laminated plastic.
 - b. Color:
 - 1) Nevamar – Jute – S2086T, textured finish.
 - c. Pressure laminated to core with water resistant adhesive.
 - 2. Cores:
 - a. Core material: 45 LB density particleboard.
 - b. Additional Plate Steel at pilasters only:
 - 1) Continuous, 11 GA steel plate in center of particleboard plies.
 - 2) Full height at all Pilasters.
 - 3. Component Thicknesses:
 - a. Pilasters: 1-1/4 IN.
 - b. Doors: 1 IN.
 - c. Panels: 3/4 IN.
 - 4. Panel Height: 58 IN high.
 - a. Mounting Height: 12 IN AFF to bottom of panel; 70 IN AFF to top.
 - 5. Stall Depth: As indicated on Drawings.
- B. Accessible stalls:
 - 1. Minimum 5 FT wide.
 - 2. Doors:
 - a. Swing out.
 - b. Clear Opening Width: Minimum 32 IN between face of door and stop.
 - 3. Comply with and all locally adopted building codes and standards with regard to accessibility.
- C. Doors:
 - 1. For 32 IN or wider stalls (except accessible stalls): Minimum 26 IN wide.
 - 2. For stalls less than 32 IN wide: Minimum 24 IN wide.
- D. Pilasters:
 - 1. Ceiling-Hung:
 - a. Complete with threaded rods, lock washers, and leveling adjustment nuts, designed to support pilasters from structure without transmitting any load to finish ceiling.
 - b. Stainless steel top trim piece, finished to match hardware, 3 IN wide.
- E. Urinal Screens:
 - 1. Wall-hung (cantilever):
 - a. Size:
 - 1) 18 IN x 42 IN.
 - b. Same construction and finish as toilet compartments.
 - c. Provide extra heavy stirrups for securing to walls.
- F. Stirrup brackets:
 - 1. Manufacturer's heavy duty design for attaching panels to walls and pilasters.
 - 2. Chromium plated brass or Type 302 stainless steel.
- G. Operational Hardware:
 - 1. General:
 - a. Provide the following at all stalls.
 - b. Material: All items are chromium plated brass or stainless steel.
 - 2. Universal Knob/Lever.
 - a. Concealed in door.
 - b. ADA compliant.
 - c. Emergency Access.

3. Door pull.
- H. Bumper coat hook:
 1. Rubber tipped combination bumper and coat hook.
 2. Provide one for each compartment.
- I. Pivot hinges:
 1. Cam action, self closing, inset into cut-out in door.
 2. Top Pivot: 13mm 1/2 IN nylon pin.
 3. Bottom Pivot: 4.8mm 3/16 IN Stainless Steel pin.
 4. Body Material: Chromium plated brass or stainless steel.
 - a. Adjustable to permit doors to rest position at any angle within a 270 Deg arc.
- J. Related Toilet Accessories: As specified in Section 10 28 13, Toilet Accessories.
- K. Anchorages and fasteners:
 1. Exposed fasteners: Tamper-resistant, stainless steel or brass, finish to match hardware.
 2. Concealed anchors: Galvanized steel, hot dip coated after fabrication complying with ASTM-A385.

2.4 FABRICATION

- A. Pre-assemble units in shop to maximum extent possible to minimize field cutting and jointing.
- B. Fabricate system in accordance with manufacturer's specifications.
- C. Pressure laminate sheets to faces and edges of core material.
- D. Provide concealed reinforcement for installation of hardware, fittings, brackets, and required accessories.
 1. Reinforce partition panels for attachment of grab bars, when bars are indicated.
- E. Exposed metal and hardware finishes:
 1. Stainless steel:
 - a. ASTM-A480, bright polished finish No. 4; or
 - b. ANSI/BHMA-A156.18, Code 629; to match US32.
 2. On brass, bronze and steel:
 - a. ASTM-B456, SC-2 bright chromium plated over nickel plating; or
 - b. ANSI/BHMA-A156.18, Code 625 on brass and bronze, Code 651 on steel; to match US26.
 3. Aluminum:
 - a. AA-M12C22A31 clear satin anodized; or
 - b. ANSI/BHMA-A156.18, Code 628; to match US28.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate Wall Backing has been installed.
 1. Metal Wall Backing: Specified in Section 09 22 16.
 2. Coordinate and direct installation of backing where required for Toilet Partitions and accessories.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install in a rigid, straight, plumb and level manner, to indicated lay out.
- B. Clearances:
 - 1. Between pilasters and panels: Maximum 1/2 IN.
 - 2. Between panels and walls: Maximum 1 IN.
 - 3. Between doors and pilasters: Maximum 3/16 IN.
 - 4. Between floor and bottom of panels: 12 IN.
- C. Secure to walls with minimum of 2 stirrup brackets near top and bottom of panel.
 - 1. Locate brackets so holes occur in masonry or tile joints.
 - 2. Use manufacturer's recommended anchoring devices, as indicated on shop drawings.
- D. Ceiling-hung partitions:
 - 1. Secure pilasters to supporting structural framing with specified anchorage device.
 - 2. Level, plumb, and tighten.
 - 3. Set bottoms of closed doors level with bottom of pilaster.
- E. Urinal Screens:
 - 1. Attach with heavy duty concealed anchoring devices.
 - 2. Provide wall channels, wall plates and studs as recommended by manufacturer to suit wall construction.
 - 3. Provide floor and ceiling attachment devices where applicable.
 - 4. Set units in accordance with manufacturer's instructions to support units and resist impact.

3.3 ADJUST AND CLEAN

- A. Adjust and lubricate hardware for proper operation after installation.
 - 1. Set hinges on in-swing doors to hold unlatched doors open approximately 30 degrees.
 - 2. Set hinges on out-swing doors to return to fully closed position.
- B. Protect until time of acceptance by Owner.
- C. Replace damaged work as directed.
- D. Perform final adjustments just prior to final inspection.
- E. Clean exposed surfaces, hardware, fittings and accessories and touch up minor scratches and other imperfections using materials and methods recommended by manufacturer.

END OF SECTION

SECTION 10 26 00
WALL PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Single source responsibility:
 - 1. Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Showing locations, extent and installation details of corner guards and wall guard.
 - 2. Show methods of attachment to adjoining construction.
- B. Samples:
 - 1. Furnish two 12 IN long/square samples of each item as noted in Room Finish and Color Schedule, Section 09 06 10.
 - a. Include end cap and mounting hardware.
- C. Project Information:
 - 1. Certification that products used within this section are 100 percent free of polyvinyl chloride (PVC).
- D. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Interior finish fire performance data (for each item and type specified):
 - a. Manufacturer's printed information including:
 - 1) Fire class.
 - 2) NFPA test number.
 - 3) Photograph.
 - 4) Proof of purchase.
 - 5) See Section 01 78 26.
- E. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section

1.3 DELIVERY, STORAGE AND HANDLING

- A. Schedule delivery of anchorage components as required for installation.
- B. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements.
 - 1. Maintain storage conditions between 40 DegF and 100 DegF.
- C. Store material flat.

1.4 PROJECT CONDITIONS

- A. Materials must be acclimated in an environment of 65-75 DegF for at least 24 hours prior to beginning the installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Wall Protection Specialties:
 - a. Base:
 - 1) Alpar.
 - b. Optional manufacturer's must meet the following criteria:
 - 1) Metal components must contain a minimum of 25% post-consumer recycled content.
 - 2) Wall guard must meet the following criteria:
 - a) PVC-free
 - b) Contain 88% rapidly renewable materials, all of which are harvest in a one-year cycle.
 - c) Free of petroleum, chlorine and persistent bioaccumulative toxins (PBTs)
 - d) Biodegradable and approved by the Environmental Protection Agency (EPA).
 - 2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS - GENERAL REQUIREMENTS

- A. The following general material requirements apply to all vinyl/acrylic wall protection devices.
 - 1. Cover Material:
 - a. High-impact, rigid vinyl/acrylic, homogeneous color throughout entire thickness, free of embedded foreign material, and having a blemish free surface.
 - 2. Retainer assemblies:
 - a. Material: 6063-T6 aluminum (ASTM-B221).
 - b. Finish: Anodized finish complying with AAMA 611, Class II
 - 3. End Caps:
 - a. Pre-fabricated, color-matched rigid vinyl/acrylic.
 - b. Mechanically secured with concealed fasteners.
 - 4. Fasteners:
 - a. Non-corrosive and compatible with aluminum retainers.
 - b. Attachment hardware type: As appropriate for wall construction.
 - 5. Impact Strength: Tested in accordance with the applicable provisions of ASTM-F476.
 - 6. Chemical and stain resistance: In accordance with ASTM-D1308.
 - a. Resistant to alkali, chemicals, cleaning agents and light.
 - 7. Color match: Provide wall protection components that are color matched in accordance with the following: Delta E difference of no greater than 1.5 using the Hunter (Lab) Scale.
 - 8. Fire performance characteristics (UL-listed and tested per in accordance with ASTM-E84 (CAN/ULC S102.2) for Class I (Class A) characteristics listed below:
 - a. Flame Spread Index: < 25.
 - b. Smoke Developed: < 450.
 - 9. Include fasteners, mounting brackets, and hardware necessary for installations indicated.

2.3 STAINLESS STEEL CORNER GUARDS (CG)

- A. General:

1. Material: Type 304 or 430 Stainless Steel w/satin finish.
2. Sheet thickness: 0.0625 IN (16 GA).
3. Unit Length: Full height.
4. Provide custom units where substrate corners are other than 90 DEG.

2.4 WALL GUARD (WG)

- A. Wall Guard (WG) sheets & accessories:
 1. Base Product: Wall Guard S-040 by Alpar.
 2. Material: High-impact, rigid vinyl/acrylic.
 3. Sheet Thickness: 0.040 IN.
 4. Color(s), Pattern(s) and Texture(s):
 - a. As scheduled in Section 09 06 10.
 5. Include prefabricated trim items:
 - a. Inside and outside corners.
 - b. Wainscot cap molding.
 - c. Vertical joint mouldings (where specified in Part 3)
 6. Include appropriate primers, adhesives, and sealants.
 - a. Adhesive shall have a VOC content no greater than 50 g/L.

2.5 FABRICATION

- A. Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General:
 1. Verify that walls are in proper condition to receive installation of wall protection items.
 2. Correct unsatisfactory conditions.
 3. Start of installation indicates acceptance of responsibility for performance.
- B. Verify that temperature at the time of installation is between 65-75 DegF and will be maintained in this range throughout installation and for at least 48 hours after completion.
- C. Insure that adequate Wall Backing has been installed.
 1. Metal Wall Backing: Specified in Section 09 22 16.
 2. Coordinate with other trades to ensure that backing is installed as walls are framed and prior to installation of gypsum wall board.
 3. Coordinate and direct installation of backing required for Wall Protection Specialties scheduled.
- D. Install surface-mounted items after wall finishes have been completed.

3.2 INSTALLATION – GENERAL REQUIREMENTS

- A. General:
 1. Install in accordance with the manufacturer's recommendations, using only approved mounting hardware, and locating all components firmly into position, level and plumb.
 2. Install with fasteners suitable for wall substrates encountered, and provide adequate anchoring for anticipated impact loads.
- B. Install items where indicated.
- C. Install end caps, returns, transition etc.

3.3 INSTALLATION - CORNER GUARDS

- A. General:
 - 1. Comply with general requirements in Part 3.2.
 - 2. Unless otherwise indicated: Align bottom edge of corner guards with top of Wall Base.
- B. Stainless Steel Corner Guards (CG):
 - 1. Fasten directly to finished wall surfaces using adhesive as recommended by manufacturer.
 - a. Augment with stainless steel fasteners.

3.4 INSTALLATION - WALL GUARD (WG)

- A. General:
 - 1. Install Wall Guard where indicated.
 - 2. Prepare substrates as required to receive Wall Guard.
 - 3. Install in accordance with manufacturer's recommendations.
 - 4. Comply with general requirements indicated in Part 3.2.
- B. Preparation – WG over New Gypsum Wallboard:
 - 1. Ensure new drywall has been taped and sanded smooth.
 - 2. Wipe clean to remove dust.
- C. Wainscot (partial-height) installations (where indicated):
 - 1. Start bottom edge at floor line and install prior to installation of Wall Base.
 - a. Install Wall Base “over” Wall Guard.
 - 2. Install sheets horizontally to top-of-wainscot height and terminate with color-coordinated trim cap.
 - 3. Top-of-Wainscot Height:
 - a. 48 IN AFF (unless otherwise indicated).
 - 4. Vertical Joints (butt-joints):
 - a. Install wall guard with butted joints and matching colored sealant.
 - b. Joint width: 1/16 IN.
- D. Sealant:
 - 1. Specified in Section 07 92 16.
 - 2. Seal to adjacent finish materials including top edge, lateral edges and bottom edge.

3.5 ADJUSTING AND CLEANING

- A. Adjust installed end caps as necessary to ensure tight seams.
- B. Remove and replace defective, misaligned or damaged units.
- C. Verify that wall protection items are plumb and rigidly secured to substrate; make any adjustments required.
- D. Remove protective films.
- E. Clean items adjacent areas, using materials and methods recommended by manufacturer.

3.6 PROTECTION

- A. Protect installed materials to prevent damage by other trades.

END OF SECTION

SECTION 10 28 13
TOILET AND BATH ACCESSORIES (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Toilet and Bath Accessories, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Letter stating that extra material has been delivered.
- B. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General:
 - 1. As noted for individual items.
 - 2. Not all manufacturers are approved for each item.
 - 3. Provide equipment from one manufacturer as far as is practicable.
- B. Toilet and Bath Accessories:
 - 1. Base:
 - a. American Specialties (unless otherwise noted for specific items).
 - 2. Optional:
 - a. Bobrick Washroom Equipment.
 - b. Bradley.
 - c. GAMCO a Division of Bobrick.
 - d. Tubular Specialties Manufacturing (TSM).
- C. Electric Hand Dryers:
 - 1. Base:
 - a. Dyson.
- D. Undersink Protectives:
 - 1. Base:
 - a. Truebro, Inc.
 - 2. Optional:
 - a. McGuire.

- E. Laptop Basket:
 - 1. Base:
 - a. Ergotron
 - 2. Optional:
 - a. Custom stainless steel fabrication.
- F. Other manufacturers of a complete line of stainless steel accessories desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Stainless steel, unless noted otherwise.
 - 1. Quality: ASTM-A167, Type 304, 18-8.
 - 2. Finish: Satin finish on exposed surfaces.
 - 3. Exception: TA-2 and TA-3, aluminum.
- B. See drawings for items, quantities, and locations required.
- C. Grab Bars - General:
 - 1. Material: Satin stainless steel, ASTM-A167, Type 304 18-8.
 - 2. Bar Diameter: 1-1/2 IN OD,
 - 3. Concealed mounting.
 - 4. 1/1-2 IN clearance between bar and wall.
 - 5. Modify manufacturer's standard units if required.
 - 6. Fully weld bars to flanges.
 - 7. Base Products: 3800 Series by American Specialties.
 - 8. Provide anchoring devices to withstand minimum concentrated load of 250 LB and 454kg 1000 LB at bariatric locations.
 - a. Mounting devices for metal stud, gypsum wall board or plaster walls.
 - b. Mounting devices for concrete block walls.
 - c. Mounting devices for concrete walls.
 - d. Mounting devices for toilet partitions.
 - e. Mounting on other surfaces: As recommended by manufacturer.
- D. Locks:
 - 1. Tumbler locks keyed alike.
- E. Provide corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories
- F. Provide one extra TA item of each type; except TA-4, TA-20, TA-G series; per 100 items furnished.
- G. Minimum extra pieces regardless total number: One.
- H. Furnish packed in original boxes, identified on outside of package to TA number and description.

2.3 TOILET ACCESSORIES

AD-4:

- A. Feminine Napkin Dispensers and Disposers:

FEMININE NAPKIN DISPENSERS and DISPOSERS					
TA	NAME	ASI	BOBRICK	BRADLEY	REMARKS
4	Feminine Napkin-Tampon Dispenser	0862-25	B-282	426-25	25 cent operation

5	Feminine Napkin Disposer	0852	B-270	4781-15	
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B. Paper Towel Dispensers:

PAPER TOWEL DISPENSERS - MANUAL					
TA	NAME	ASI	BOBRICK	BRADLEY	REMARKS
6	Semi-recessed Combination Paper Towel Dispenser/Disposal	0469	B-3944	234	Multi-fold format Towel slot,1220mm 48IN AFF
7	Surface-mounted Paper Towel Dispenser	0210	B-262	250-15	Multi-fold format

AD-4:

AD-4:

C. Soap Dispensers:

SOAP DISPENSERS					
TA	NAME	ASI	BOBRICK	BRADLEY	REMARKS
9	Wall-mounted Liquid Soap Dispenser (with all purpose valve)	0345 Horizontal	B-2112	6542	
9A	Countertop-mounted Liquid Soap Dispenser (manual)	0332-D	B-8226	6326-68	150 mm 6 IN spout 1L 34 OZ Right hand side of sink Spout over basin

D. Miscellaneous:

MISCELLANEOUS					
TA	NAME	ASI	BOBRICK	BRADLEY	REMARKS
10	Mop-Broom Rack (26 IN, 3 Holders)	8215-3	B-223X24	9953-3	

AD-4:

E. Grab Bar Types:

GRAB BARS					
TA	NAME	ASI	BOBRICK	BRADLEY	REMARKS
G36	Grab Bar, 36 IN Horizontal	3801-36	B-6806-36	812-001-36	
G42	Grab Bar, 42 IN Horizontal	3801-42	B-6806-42	812-001-42	

2.4 UNDERSINK PROTECTIVES (SPECIFIED ELSEWHERE)

- A. Pipe-wrap: Specified in Section 22 42 00.

2.5 TOILET ACCESSORIES – HIGH-SPEED ELECTRIC HAND DRYERS

- A. Surface-mounted, ADAAG-compliant, High-Speed Electric Hand Dryer:
 - 1. General:
 - a. Base Product: “Airblade” by Dyson.
 - b. Owner furnished and Contractor installed.
- B. Installation:
 - 1. Install at height designated by manufacturer for ADA compliance, according to “front” approach:

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate wall backing has been installed.
 - 1. Utilize proprietary backing devices where specified.
 - a. Where not specified: Utilize sheet metal strap-type wall backing, Specified in Section 09 22 16.
 - b. Coordinate and direct installation backing where required for toilet accessories.
- C. Verify substrate and blocking for attachment of wall-mounted accessories is ready for installation of accessories.
- D. Correct deficiencies before proceeding to install accessories.
- E. Where item is mounted on or in a toilet partition, coordinate interior reinforcing location with partition manufacturer.
- F. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer’s instructions.
 - 1. Install plumb, level, and rigidly anchored to substrates.
- B. Where drawings or schedule require barrier-free accessibility, install accessories in accordance with applicable regulations.
- C. Coordinate accessory locations to fit spaces.
- D. Coordinate items to avoid mounting conflicts.
- E. Provide additional accessories indicated on drawings.
- F. Mount at height indicated.
- G. Mount items with theft-resistant fasteners.

3.3 ADJUSTING AND CLEANING

- A. Protect accessories from damage due to construction.
 - 1. Remove protective coverings when no longer required.
- B. Test accessories and adjust for proper operation.

C. Clean exposed surfaces.

END OF SECTION

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SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Fire Protection Specialties, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements for portable fire extinguishers.
- B. Provide fire extinguishers, cabinets and accessories by single manufacturer.
- C. Fire-Rated Cabinets: Listed and labeled to comply with requirements in ASTM-E814 for fire-resistance rating of walls where they are installed.
- D. Non-magnetic Fire Extinguishers: UL listed and in compliance with ASTM 2503, and tested to 3 Tesla.
- E. Conform to Americans with Disabilities Act (ADA) regarding mounting heights and maximum projection of cabinets into corridors.

1.3 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Maintenance data.
- B. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver cabinets in time to allow installation.
- B. Deliver and install filled and charged extinguishers just prior to building occupancy.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Fire Protection Specialties:
 - a. Base:
 - 1) JL Industries.
 - b. Optional:

- 1) Amerex.
- 2) Larsen's Manufacturing.
2. Fire Extinguishers:
 - 1) JL Industries.
 - b. Optional:
 - 1) Amerex.
 - 2) Badger.
3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 FIRE EXTINGUISHER (FE)

- A. General:
 1. Determine proper type of extinguisher required for room in which they are indicated.
 2. Coordinate cabinet and extinguisher sizes. Bring discrepancies to attention of Architect.
 3. Include wall brackets where extinguishers (FE) are indicated without cabinets.
 4. Provide FIRE EXTINGUISHER decal for each extinguisher.
- B. Multi-Purpose Chemical Fire Extinguishers; typical FE, except where more specialized types are required:
 1. Extinguishing Agent: Specially fluidized and siliconized chemical powder suitable for classes A, B, C fires.
 2. Construction:
 - a. Heavy-duty steel cylinder with metal valve and siphon tube with replaceable molded valve stem seal, visual pressure gauge, pull pin and upright squeeze grip.
 - b. Corrosion and impact-resistant, powder coat finish.
 - c. Color: Red, in accordance with OSHA requirements.
 3. Capacity: 10 LBS.
 - a. UL-rating: 4A-80BC.
 - b. Base Product Model: "Cosmic 10E" by JL Industries.
 4. Locations; Provide one FE for each:
 - a. Fire Extinguisher Cabinet (FEC).
 - b. Fire Extinguisher (FE) location.

2.3 FIRE EXTINGUISHER CABINETS (FEC)

- A. General:
 1. Provide FIRE EXTINGUISHER decal for each cabinet. Orient letters vertically.
 2. Provide fixed door pull at each cabinet.
 3. Keys to Door Locks: Three per lock.
- B. **FEC-1** – Semi-recessed, Steel, Fire Extinguisher Cabinet:
 1. Description: Semi-recessed cold rolled steel tub with 3 IN rolled edge steel trim style and door.
 - a. Fire-rated Cabinets: Provide fire-rated cabinets where FEC-1 is indicated to be installed in fire-rated walls.
 - b. Maximum projection from wall surface: 3IN.
 2. Cabinet Construction:
 - a. Non-fire rated Cabinets: Single-wall, 0.026 IN (26 GA) cold-rolled steel.
 - b. Fire Rated Cabinets: Double-wall construction fabricated from 0.043 IN (18 GA) cold-rolled steel lined with minimum 5/8 IN thick, fire-barrier material.
 3. Finish: Powder coated.
 - a. Color: White.
 4. Tub Size, inside clear (WxTxD): 10-1/2 x 24 x 6 IN.
 5. Door Style: Full Glazing; Clear acrylic.
 6. Lock: Cam lock with emergency break-away release mechanism.
 - a. Base Product: "Saf-T-Lok" by JL Industries.
 7. Base Product: "Ambassador" Series 1017 and "Ambassador FX" series by JL Industries.

2.4 WALL BRACKETS

- A. Wall Brackets:
 - 1. Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated
 - 2. Finish: Baked-enamel or powder coat.
 - 3. Color: Black.
 - 4. Include mounting accessories suitable for substrate wall type.
 - 5. Locations: Install wall brackets for each fire extinguisher (FE) not indicated to be installed in a cabinet.

2.5 FABRICATION

- A. Cabinets:
 - 1. Provide manufacturer's standard box with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 2. Weld joints and grind smooth.
 - 3. Provide factory-drilled mounting holes.
 - 4. Prepare doors and frames to receive locks.
 - 5. Install door locks at factory.
- B. Cabinet Doors:
 - 1. Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 2. Fabricate door frames with tubular stiles and rails and hollow-metal design, 1/2 IN thick.
- C. Cabinet Trim:
 - 1. Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrates to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. General:
 - 1. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 2. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturers instructions.
 - 3. Securely fasten mounting brackets and cabinets to structure, square and plumb, to comply with manufacturer's instructions.
 - 4. Install in accordance with NFPA-10 and manufacturer's instructions.

5. Provide required closures.
- B. Installation Heights:
1. General:
 - a. Install extinguishers and cabinets with in limitations of NFPA-10 and ADA.
 2. Fire Extinguisher Cabinets (FEC):
 - a. Locate with centerline of cabinet door handle not more than 48 IN AFF.
 - b. Exception: Extinguishers with at gross weight > 40 LBS: Locate with centerline of cabinet door handle not higher than 24 IN AFF.
 3. Fire Extinguishers (FE) not contained in a cabinet:
 - a. Locate wall brackets such that top of extinguisher will not be higher 48 IN AFF.
 - b. Exception: Extinguishers with at gross weight greater than 40 LBS: Install with extinguisher top not more than 36 IN above floor.

3.3 PROTECTION

- A. Protect installed items from damage.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films.
- B. Adjust fire protection cabinet doors to operate easily without binding.
1. Verify that integral locking devices operate properly.
- C. Clean interior and exterior surfaces.
- D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance.
1. Conform with procedures recommended by manufacturer.
- E. Replace items that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 11 13 16
DOCK SEAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Dock Seal, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Verify suitability of substrate to accept installation. Installation assumes responsibility for performance.

1.3 SUBMITTALS

- A. Contract closeout information:
 - 1. Operating and maintenance data.
 - 2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Dock Seal:
 - 1. Base:
 - a. Frommelt/Rite-Hite.
 - 2. Optional:
 - a. Chalfant Sewing Fabrications.
 - b. Fairborn USA, Inc.
 - c. W.B. McGuire Company.
 - d. Pentalift Equipment Corporation.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 - 1. Cover material:
 - a. Hypalon-coated nylon.
 - 1) Minimum Weight:
 - a) 40 OZ.
 - 2. Color as selected.
 - 3. Taper dock seal (top to bottom):
 - a. Where ramp slope is less than 2.5%: Face of Dock Seal shall be plumb.
 - b. Where ramp slope is 2.5 to 5%: Face of Dock Seal shall have a 1 IN taper vertically.
 - c. Taper an additional 1 IN for every 2.5% thereafter.
 - d. Taper direction according to the inclination/declination of the approach ramp.
 - 4. Framing:
 - a. 2 IN (nom) kiln dried, preservative treated wood, fully encased with cover fabric, galvanized steel hardware.
 - 5. Side Pads:
 - a. Bevel side pads from 6 to 12-1/2 IN (back to front).

- b. Armor pleat exposure:
 - 1) 4 IN.
 - c. Vertical yellow guide stripe: 3 IN wide.
 - 6. Bottom pad and bumpers:
 - a. Three foam pads.
 - b. Hypalon-coated nylon fabric.
 - c. 12 IN steel channel frame.
 - d. Two laminated tread bumpers
 - e. Base Product: "Frommelt Type U3" by Rite Hite.
 - 7. Base Product: "Frommelt Foam Fit Standard Pads, Series TP-900" by Rite Hite.
- B. Fixed Head Pad:
 - 1. Fabric type and color matching side pads.
 - 2. Vertical Height:
 - a. 24 IN.
 - 3. Counter-flashed, watertight construction.
- C. Metal Hood:
 - 1. Provide manufacturer's standard metal hood.
- D. Bumpers:
 - 1. Include extended bumpers as required to prevent over-compression of the foam dock seals.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Do not start work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install in accord with manufacturers recommendations.
- B. Attach dock seals to the structure in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

3.3 ADJUST AND CLEAN

- A. Make necessary adjustments for safe, efficient operation of loading dock equipment.
- B. After installation, restore marred, abraded surfaces to the original condition.

END OF SECTION

SECTION 11 13 17
DOCK BUMPERS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Project information:
 - 1. Manufacturer of listed products.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver anchorage items in time for installation.

1.3 JOB CONDITIONS

- A. Furnish templates and anchor accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Dock Bumpers:
 - a. Base:
 - 1) Rite-Hite.
 - b. Optional:
 - 1) Durable.
 - 2) Pawling.
 - 3) Serco.
- B. Dock Bumpers:
 - 1. Laminated tread type.
 - 2. Multiple plies cut from fabric reinforced rubber truck tires, assembled under high pressure on steel supporting rods or bar with steel closures and attachment assembly.
 - 3. Use plies cut to uniform size extending not less than 4 IN from face of dock when in place.
 - 4. Mount with structural steel angle closures not less than 1/4 IN thick.
 - 5. Size angles to allow face of tread plies to extend not less than 1 IN beyond standing legs of closure angles with other leg sized to allow for attachment.
 - 6. Bumper dimensions as indicated.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate for suitability for installation.
- B. Correct unsatisfactory conditions.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install bumpers, as indicated, 1 IN below dock level, and in horizontal direction.
- B. Attach to structure.
 - 1. Verify and coordinate location and size of inserts.

- C. Attach to concrete construction by drilling or anchoring as follows:
 - 1. Mount using drilled anchors.

END OF SECTION

SECTION 11 13 19
DOCK LEVELERS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Dock Levelers and Equipment, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Take field measurements prior to fabrication, to ensure proper fitting of work.
- B. Do not delay job progress.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Showing:
 - a. Pit dimensions and configuration.
 - b. Anchorage of curb angle and embedded plates.
 - c. Rough-in requirements.
- B. Contract Closeout Information:
 - 1. Operating and maintenance data.
 - 2. Owner instruction report.
 - 3. Warranty.

1.4 WARRANTY

- A. Provide written, minimum 5-year warranty on all mechanical and 10-years on structural components.
 - 1. Warranty jointly signed by Manufacturer and Contractor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Pit-mounted Dock Levelers:
 - 1. Base:
 - a. Rite-Hite.
 - 2. Optional:
 - a. Blue Giant.
 - b. Chalfant
 - c. W.B. McGuire Company.
 - d. Pentalift Equipment Corporation.
 - e. Serco.
- B. Door Track Guards:
 - 1. Base:
 - a. Rite-Hite.
 - 2. Optional:
 - a. Omega Industrial Products.
 - b. Cubic Designs Inc.

- C. Miscellaneous Dock Equipment:
 - 1. Base:
 - a. Rite-Hite.
 - 2. Optional:
 - a. Serco.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 - 1. Recessed, pit-mounted adjustable dock leveler(s).
 - 2. Hydraulically operated ramp and lip.
 - 3. Complete with platform, hinged lip, toe guards, bumpers and safety stop, complying with ANSI-MH30.1 and CS202.
 - 4. Nominal Size:
 - a. 7 FT wide x 8 FT long.
 - 5. Vertical travel:
 - a. Minimum 12 IN, above and below platform level.
 - 6. Capacity:
 - a. 20,000 LB live load, for rollover and cross traffic, with ultimate static capacity at least 150% of rated capacity without permanent deflection or distortion.
 - 7. Hydraulic Power Unit:
 - a. Electric motor and hydraulic pump and slave cylinder.
 - b. Voltage:
 - 1) 120 VAC, 1 PH.
 - c. Oil reservoir shall be translucent polyethylene to allow visual fluid level inspection.
 - 8. Material:
 - a. Metal work exposed to view:
 - b. Smooth and free of surface blemishes including pitting, seam marks, roller marks and roughness.
 - c. Deck steel plate: safety plate, with minimum yield of 55,000 PSI.
 - d. Structural steel plates, shapes and bars: ASTM-A36.
 - e. Structural steel tubing: ASTM-A501.
 - 9. Finish:
 - a. Hot dip galvanize all components of leveler, prior to priming/painting.
 - 1) Comply with G90.
 - 10. Base Product: "Model RHH" by Rite-Hite.
- B. Frame:
 - 1. Steel, welded and reinforced to meet performance requirements and to provide rigid support.
 - 2. Leveler frame shall be constructed to accommodate easy cleaning on both sides of a single center frame member.
 - a. There shall be no side-to-side subframe steel between front and rear of pit.
- C. Platform:
 - 1. One piece deck steel plate unit with non-skid surface, mounted to frame.
 - 2. Construct sufficiently rigid to accommodate rated capacity.
 - 3. Platform shall be designed to flex a maximum of 4 IN to compensate for unlevel trailer beds.
 - 4. Rear hinges shall be fixed and shall not rise above floor level.
 - 5. Hinge shall have grease fittings for maintenance.
- D. Lip:
 - 1. 1-piece steel plate of skid resistant material platform surface.
 - a. Length: Minimum 18 IN by width of platform (13 IN (min) beyond standard bumpers).

2. Reinforce to prevent deformation.
 3. Chamfer lip edge to provide minimum obstruction to wheels of vehicles.
 4. Functions as a vertical cover for actuating mechanism when in stored position and as an equipment run-off barrier on front edge of ramp.
 - a. When leveler is in stored position, the leveler lip will provide an integral and automatically- positioned, impact-rated, solid barrier 5 IN above building floor to help prevent accidental falls from vacant dock positions.
 5. Hinge shall have grease fittings for maintenance.
- E. Toe Guards:
1. Provide toe guard at sides of platform of sufficient depth to provide protection of open sides throughout working range.
 2. Minimum 3/16 IN thick steel, welded to leveler platform.
- F. Safety features:
1. Manufacturer's standard safety stop device:
 - a. Designed to limit downward travel of loaded platform to maximum of 3 IN if carrier bed is suddenly withdrawn.
 2. Mechanical lock-out device:
 - a. To be manually inserted under platform to prevent collapse during maintenance.
 - b. Designed to remain in place if the platform is accidentally raised to its highest operating position or is impacted from the side or rear by a fork truck.
- G. Steel edge angles:
1. Size: 3x3 x 3/16 IN galvanized steel angles with 1/2 IN diameter x 6 IN long headed studs at 12 IN. on center.
 2. Provide at entire perimeter of pit.
- H. Miscellaneous features:
1. Automatic night locks to be integral part of manufacturer's standard dock levelers.
 2. Weatherseal: Provide around all exposed joints between leveler components.
 - a. Under-leveler seal: Flexible vinyl cover to seal under platform gap at pit sides and top to maintain seal when leveler is in above-dock position up to 3 IN, and leveler lip corner seals.
 - 1) Include filler bumper pads to close gaps between leveler and dock seals when truck is in place.
 - 2) Provide manual disconnect feature allowing ease of removal for leveler maintenance access.
 - b. Base Product: Frommelt PitMaster Under-Leveler Seal.by Rite Hite.
 3. Overhead Door interlock.

2.3 DOCK BUMPERS

- A. Dock Bumpers:
1. Install two dock bumpers with each leveler.
 2. Type: Laminated. Molded is not acceptable.
 3. Size: 15 IN high x 4 IN deep x 12 IN wide.
 4. Include manufacturer's standard embed plates and installation hardware.

2.4 DOCK SEALS

- A. Dock Seals: Specified in Section 11 13 16.

2.5 CONTROL PANEL

- A. Control panel:
1. At each dock bay, provide a single panel to control all dock devices specified for that bay, including:
 - a. Dock Leveler.
 - b. Overhead Door.

- c. Dock Light
- 2. Features:
 - a. All operator controls shall be mounted in gasketed control panel.
 - b. Control Panel to provide for a single power connection for all associated dock equipment.
 - 1) Include internal step-down transformer(s) as required for any devices which require voltage other than that required by the dock leveler.
 - c. Door Control Push Buttons: Include OPEN, CLOSE, and STOP buttons.
 - d. Control panel shall incorporate the additional components required to provide the desired interconnect and interlock package.
 - e. Control panel to provide an integral rotary fused disconnect that allows compliance with OSHA lock out/tag out requirements and a protective guard to protect workers from accidental contact with incoming power.
 - f. Control panel to incorporate a selector switch allowing activation of the locally supplied dock light.
 - g. Control panel to incorporate an integral 15 AMP duplex outlet (for convenience).
- 3. Control Panel to be supplied by the same manufacturer as the Dock Leveler and Truck Restraint.
- 4. Components will be solid state to allow flexibility for interconnection with other powered dock equipment.
- 5. All individual components, as well as the complete box unit, shall be UL-approved.
 - a. Gasketed, NEMA-12 enclosure.
- 6. Base Product: "Dok-Commander" by Rite-Hite.

2.6 DOCK LIGHT

- A. Single lamp head on flexible, articulating arms.
 - 1. Provide one for each dock bay.
 - 2. Base Product: "Cool Head" by Rite-Hite.

2.7 TRACK GUARDS

- A. Description:
 - 1. Rigid, 1/4 IN thick steel, fabrication which wraps around, and protects lower portion of overhead door tracks.
 - 2. Length of coverage:
 - a. 24 IN tall.
 - b. 36 IN tall.
 - c. 48 IN tall.
 - 3. Include necessary anchorages and blocking as required.
 - 4. Finish: Powder-coated at factory.
 - 5. Color: High-visibility Safety Yellow paint.
 - 6. Base Product: "Warden Series" by Rite Hite.

2.8 OPERATION – PIT-MOUNTED DOCK LEVELER

- A. Sequence:
 - 1. The platform is raised by attendant pushing, and holding the button on control panel.
 - 2. Raising of the ramp automatically causes the lip to extend.
 - 3. Releasing the button will allow the platform to lower to the truck bed (12 IN above or below the dock height).
 - 4. Upon departure of the truck, the leveler automatically shall recycle to level position with lip folded down.
 - a. When lip is folded down, its hinge-edge shall slide vertically up to form a 5 IN IN high equipment run-off barrier.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify suitability of substrate and opening to accept installation.
 - 1. Correct unsatisfactory conditions.
 - 2. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION – PIT-MOUNTED DOCK LEVELER

- A. Install in accord with manufacturer's instructions.
- B. Shim as necessary; weld into pit.
- C. Final power hookup by Electrical Specification Divisions.
- D. Adjust for safe, efficient operation.
- E. Restore marred or abraded surfaces.
- F. Install sealant to seal between concrete and unit.

3.3 INSTALLATION - TRACK GUARD

- A. General:
 - 1. Install Track Guards to protect door tracks at jambs of overhead doors.
 - 2. Anchor to wall and floor.
 - 3. Block-out from wall as required to accommodate deep tracks.

3.4 INSPECTION

- A. Manufacturer's representative shall install dock equipment and confirm that it is accordance with approved shop drawings and manufacturer's recommendations.
 - 1. Test to ensure proper operation.
 - a. Test ramp operation and vertical travel limits to comply with specified requirements.
 - b. Verify lip extension length.
 - c. Test emergency stop mechanism.
 - d. Test truck restraint operation.
 - 2. Require that all connections and adjustments necessary to assure proper operation of dock levelers be made.
 - 3. Before acceptance, a demonstration shall be conducted in the presence of the Laboratory's representative that all levelers operate properly in every respect.
- B. User/Operator Training:
 - 1. Conducted at time and place agreed upon by Laboratory.

END OF SECTION

SECTION 11 24 26

SAFETY TIE-BACKS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Description of system:
 - 1. Design, fabrication, and installation of safety tie-backs anchored to the roof structure for the purpose of window washing and general building maintenance including:
 - a. Single eye safety tiebacks.
 - b. Signage indicating safe usage and restrictions.
 - c. Instructional materials.
 - 2. System is for use by Laboratory hired, independent, window washing companies.
 - 3. Design and locate anchors such that new windows are accessible for cleaning and/or maintenance with conventionally rigged window washing equipment. Coverage shall include the following areas:
 - a. Access to punched windows and curtain wall glass which is not easily reachable by ladder from grade.
 - b. Including windows which are difficult to reach from above due to adjacent soffits and other projecting overhangs. Provide soffit and/or wall mounted anchors is so required to reach these protected areas.

1.2 QUALITY ASSURANCE

- A. Design criteria:
 - 1. Design to comply with OSHA standards.
 - 2. Design to comply with Local Building Codes and Standards.
 - 3. Design system, as a minimum, to support 5000 LBS loads applied to each anchor.
 - 4. Complete design of system with drawings and calculations sealed by a registered Structural Engineer licensed in the State of Illinois.
 - 5. Compatible with current window washing practices and standards.
 - 6. Locations shown on the Drawings are conceptual. Actual locations are to be determined by the Designer of this system.
- B. Applicator/erector qualifications:
 - 1. Fabricators minimum of 5 years experience in design, fabrication and installation of similar size and scope systems.
 - 2. Installation: By installer with minimum 5 years experience in installation of similar systems, or by fabricator.
 - 3. Manufacturers must have specific liability insurance in excess of \$2,000,000 to cover the failure on the installed system.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Showing anchorage locations and details.
 - 2. Showing proposed rigging arrangements which might be used to reach windows, including Bosun's chair, drop-stage and/or other methods.
- B. Product data.
- C. Project Information:
 - 1. Manufacturer's installation instructions and recommendations.
 - 2. Certificate stating system has been designed by registered Engineer, licensed to practice Structural Engineering in the state where project is located.

3. Instructional information regarding safe usage and restrictive uses.
- D. Contract Closeout Information:
1. Operating and maintenance data.
 2. Certificate demonstrating manufacturer's liability insurance.
 3. Warranty.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver safety tiebacks to steel erector for installation, and assist with installation.

1.5 JOB CONDITIONS

- A. Sequence and coordinate work with other affected component supplier/installers to create a totally integrated, functioning, weathertight system.

1.6 WARRANTY

- A. Manufacturers must have specific liability insurance in excess of \$2,000,000 to cover the failure on the installed system.
- B. Jointly with roofer, warrant water integrity of roof penetrations, for same period.
- C. Replace components which fail at no cost to Laboratory.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
1. Safety Tie-backs and Horizontal Lifeline Systems:
 - a. Base:
 - 1) Pro-Bel Enterprises Limited.
 - b. Optional:
 - 1) Guardian Fall Protection.
 - 2) MIO Mechanical Corp.
 - 3) High Rise Systems Inc.
 - 4) Spider Staging.
 - 5) Swing Stage.
 - 6) Summit Anchor Company.
 - 7) Boston Anchor.
 - 8) Hysafe.
 2. Other manufacturers desiring approval comply with Section 00 26 00.
- B. Design of a system of roof anchorages including locations and details as required to meet listed codes and requirements. Locations shown on the Drawings are conceptual. Actual locations as determined by the equipment supplier in Shop Drawings, but shall comply with the following:
1. All Anchors shall be located so that direct attachment to Structural Members (Concrete and/or Steel Beams where occurs) is possible. No connections which are "through-slab" only will be permitted.
 2. All proposed locations are subject to final approval by Architect/Structural Engineer of Record.
- C. Standards for components:
1. Exposed structural stainless steel: Type 304, with a yield strength of 42 KSI.
 2. Non-Exposed structural components: ATSM-A36, Type 350W with yield strength of 50 KSI for Hollow Structural Steel and 42 KSI for Plate Steel and other sections.
 3. Galvanizing: ASTM-A123.
 4. Cold -Rolled Sections: ASTM-A500 with yield strength of 55 KSI.
 5. Fastening devices: ASTM A325 or Type 304 stainless steel.

- D. Provide anchorage components fabricated of materials compatible with substrates they are to be welded or otherwise attached to.
- E. Flashing/Counterflashing:
 - 1. Specified in Section 07 54 25.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Correct unsatisfactory conditions.
- B. Start of work constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION/ERECTION

- A. Install components required to be attached to or connected with structure.
- B. Coordinate as required.
- C. Install in accord with manufacturer's instructions and approved shop drawings.
- D. No through-wall style anchors may be used unless approved by Architect.
- E. Install top of safety tie-back at 6 IN (Minimum) above adjacent roofing height, taking into account the insulation thickness at each tie-back location.
- F. Flashing and counterflashing:
 - 1. Specified in Section 07 54 25.
- G. Where contact is made between dissimilar materials, protect to prevent corrosion.
- H. Coordinate components indicated to be installed on other affected building components with those supplier/installers.
- I. Retouch damaged galvanizing.
- J. Design components for attachment directly to structural steel members.

3.3 FIELD QUALITY CONTROL

- A. Check welds to structure.
- B. Verify water integrity of flashings, with roofer.

END OF SECTION

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SECTION 11 53 00
LABORATORY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
1. Furnish and install all laboratory equipment with necessary components and accessories required to ensure a complete installation and ready for intended use as specified herein and shown on the Laboratory Furnishings Drawings.
 2. Although such work is not specifically shown or specified, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
 3. Work of this section requires close coordination with work of Division 22, 23, 24 and 26 as well as installation of Laboratory furnished components and work specified in other Sections. Sequence 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.
 4. Utility Requirements: Mechanical and electrical services have been designed for the services and loads as described for individual equipment items herein. If a manufacturer requires services in excess of those indicated, either of type, size, quantity or quality, that cost will be borne by the Contractor and shall not be justification for a change order.
 5. Refer to Equipment Schedule included in this specification.
 6. Equipment listed in this specification is classified by who furnishes (F) and installs (I) equipment items:
 - a. OFOI: Laboratory furnished/Laboratory installed.
 - b. OFCI: Laboratory furnished/contractor installed.
 - c. CFCI: Contractor furnished/contractor installed.

1.2 LABORATORY EQUIPMENT SCHEDULE

EQ #	DESCRIPTION	PROVIDED BY	REMARKS
E-01	Ice Maker	CFCI	Manitowoc QF-400 Ice Flaker and Storage Bin

1.3 UNDIVIDED RESPONSIBILITY

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work Related Sections.

1.4 REFERENCES

- A. Standards
1. ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999.
 2. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials; 2000a.
 3. ASTM MT1010: Support Columns.
 4. ASME Section VIII, Division 1, Unfired Pressure Vessels Code: for steam coils.
 5. UL 1262, as certified by ETL Testing Laboratory Inc. (except units with pH neutralization and detergent monitoring system).

1.5 SUBMITTALS

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit for review a complete materials list, including catalog data and performance data of all materials, equipment, and products for work in this Section.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details, finished and materials dimensions, utility connections and locations, sizes and loads, and schedules. Show relationship to adjoining materials and construction and requisite service, operating and installation clearances. Piping and wiring diagrams shall be included. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 inches by 17 inches (A3) in size. Blue-line or blackline prints are not acceptable.
- D. Samples: Submit for Architect's approval two (2) samples of each type of specified finish and color range available.
- E. Certifications: As a condition of acceptance, submit certification stating that equipment is complete and ready for intended function.
- F. Informational Submittals:
 - 1. Notice of factory testing.
 - 2. Manufacturer's installation, start-up and adjustment instructions.
 - 3. Statement of installer qualifications.
 - 4. Start-up report.
 - 5. Demonstration and instruction report.
 - 6. Factory Authorized Testing (FAT) Procedures: Requirements and Documentation. Include NIST calibration documentation.
 - 7. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and Laboratory's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, including non-proprietary parts, and closest factory representative for components and service. Manual shall include non-proprietary list of all valves and other serviceable components.

1.6 REGULATORY REQUIREMENTS AND SUBSTITUTIONS

- A. Regulatory:
 - 1. Specified products, materials, or systems for Project may include engineering or on file standards required by the Regulatory Agency. Contractor's substitution of products, materials or systems may require additional engineering, testing, reviews, approvals, assurances, or other information for compliance with Regulatory Agency requirements or both. Contractor shall provide all Agency approvals or other additional information required, and pay for additional costs required for Architect's services made necessary by the substitution at no increase in Contract Sum or schedule time, and as a part of substitution proposal.
 - 2. When applicable, comply with:
 - a. Underwriters Laboratory Standards.
 - b. National Electrical Code.
- B. Substitutions:
 - 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.

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. Maintain polyethylene film or other protective covering until start-up.
- B. Delivery of laboratory equipment shall occur after wet operations in building are completed.
- C. Receiving, distribution, and storage areas shall be of sufficient size and capacity to accommodate crated equipment.
- D. Laboratory equipment shall be stored in a ventilated area, protected from weather, with relative humidity of 50 percent or less at 70 degrees F (21 degrees C).
- E. Replacement: Any damage as a result of this contractors work will be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to Laboratory.

1.8 QUALIFICATIONS

- A. Contractor for work in this section shall have 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 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 equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits. Contractor and manufacturers for work of this section shall have a minimum of five years and ten installations experience installing products specified.

PART 2 - PRODUCTS

2.1 EQUIPMENT LISTING

A. ICE MAKER

- a. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers.

- 1) Manitowoc, 2110 South 26th St., Manitowoc, WI 54220, Tel: 920 682-0161.
- 2) Scotsman, 775 Corporate Woods Parkway, Vernon Hills, IL 60061, Tel: 800 726-8762.
- 3) Hoshizaki America, Inc. 618 Hwy 74, South Peachtree, GA 30269, Tel: 800 438-6087. Substitutions are permitted subject to Section 01 63 00.

- b. Ice Flaker and Storage Bin:

- 1) Basis of Design: Manitowoc QF-400 Ice Flaker and Storage Bin, as specified herein.
- 2) Description:
 - a) Ice flaker and storage bin.
 - b) Dimensions: 38.5 inches high by 26 inches wide by 26.5 inches deep (978 mm high by 660 mm wide by 673 mm deep).
 - c) Finish: Stainless steel with No. 4 finish.
- 3) Flaker:
 - a) Ice Producing Capacity: 395 lbs (179 kg) of flaked ice in 24 hours.
 - b) Condenser Unit: Air-cooled.
 - c) Operating Requirements:
 - (1) Air Temperature: 60 degrees F to 100 degrees F (16 degrees C to 38 degrees C).
 - (2) Water Temperature: 55 degrees F to 80 degrees F (13 degrees C to 27 degrees C.)
- 4) Ice Storage Bin:

- a) Description: 60 lbs. (27.2 kg) capacity ice storage bin.
- 5) Special Warranty: Warrant parts and labor on flaker for two years and compressor for five years from Date of Substantial Completion.
- 6) Utility Requirements:
 - a) Electrical: 115/60/1
 - b) Plumbing: 1/2" F.P.T. bin drain, 3/8" F.P.T. water inlet.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate location, size, and type of mechanical, power and communications services required.
- B. Before shipping, equipment shall be cleaned inside and outside, be free of rust, loose scale, and other deposits. Finished surfaces shall be protected to prevent shipping and/or storage damage. All threaded connections, flanges, and couplings shall be protected.
- C. Equipment to be disassembled before shipment to allow for rigging through a 60 inch by 84 inch door frame at the job site. Delivery shall be coordinated so that equipment can be positioned in-place prior to installation of door frames of smaller dimensions.
- D. Equipment to be securely crated and/or packaged to prevent damage during shipment. Loose parts shipped inside of the unit shall be secured.
- E. The vendor shall be responsible for delivery of the unit(s) to the job site, setting the equipment in place, unpacking and reassembly.
- F. The vendor shall verify that required utilities are available, in proper locations, and ready for use.
- G. Beginning of installation means acceptance of existing conditions by the vendor.
- H. Upon unpacking of the equipment, the vendor shall remove all debris, crating material and packaging from the location.

3.2 SITE CONDITIONS

- A. Inspection: Prior to installation of laboratory equipment, 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. Discrepancies: In the event of discrepancy, immediately notify the Architect.

3.3 EXAMINATION

- A. Examine surfaces designated to receive work for conditions that would adversely affect the finished work. Repair or replace surfaces not meeting tolerances or quality requirements governing substrate construction prior to start of work.
- B. Verify that surfaces, prepared openings, or support structures are ready to receive work.
- C. Verify field measurements and opening dimensions are as instructed by manufacturer.
- D. Inspect and verify that the required utilities are available, in proper locations and ready for use, prior to equipment installation.

3.4 WORK REQUIRED OF OTHER SECTIONS PRIOR TO INSTALLATION

- A. Install shutoff valves on service lines.
- B. Install fused disconnect switches (with lockout in OFF position) in electric supply lines near the equipment.
- C. Provide building service lines supplying specified pressures and flow rates.

- D. Provide illumination of service area, with provision of convenience outlet for maintenance.

3.5 STARTUP AND TESTING

- A. Test, clean, and adjust equipment and apparatus installed to ensure performance meets specified requirements.
- B. Operate each unit and test full range of cycles over a continuous period. Record test data.
- C. Adjust and re-test any units not meeting requirements.

3.6 DEMONSTRATION AND INSTRUCTIONS

- A. Test equipment prior to demonstration. Ensure equipment, including specified accessories, is operational.
- B. Provide demonstration of equipment operation and instruction of Laboratory's personnel.
- C. Demonstrate operating capability of equipment and systems. Include control and safety features, and service and maintenance procedures.
- D. Engage services of qualified instructor to instruct and train Laboratory's operating and maintenance personnel in operation, service, and maintenance of equipment. Provide at least two hours of instruction for each type of equipment.

3.7 CLEANING AND PROTECTION

- A. All equipment shall be protected before, during and after installation. Protect from paint, debris, and damage in the course of the construction sequence. Damage to material due to improper protection shall be cause for rejection.
- B. Packaging and debris and other waste resulting from installation of equipment shall be removed.
- C. At no time shall worker use the installed equipment as a work bench, scaffolding, or for other uses.
- D. Repair or remove and replace defective Work as directed by the Architect upon completion of installation.
- E. Clean finished equipment, touch up as required and remove and refinish damaged or soiled areas.
- F. Prior to final acceptance by Laboratory, equipment that has become damaged will be repaired or replaced according to the terms of the warranty and any external soiled surfaces will be cleaned.

END OF SECTION

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SECTION 11 53 13
FUME HOODS AND EXHAUST DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Chemical Fume Hoods, including bench mounted hoods, floor-mounted hoods, and high performance/low velocity hoods.
- B. Fume Extractor Arms (Snorkels).
- C. Custom Ventilated Enclosures (Exhaust Enclosure).

1.2 UNDIVIDED RESPONSIBILITY

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

1.3 RELATED SECTIONS

- A. Canopy hoods and low slotted exhausts are specified in Section 12 35 53 under Stainless Steel Fabrications.

1.4 DESCRIPTION

- A. Provide chemical fume hoods, fume extractor arms, and custom enclosures complete with accessories as described herein, and shown on Laboratory Furnishings drawings.
- B. Fume hoods with accessories shall be pre-piped and pre-wired.
 - 1. Pre-pipe service fittings to single point connection for each service at 6 IN above top of hood or as otherwise shown. Cup sink tailpiece shall be provided with fume hood. Refer to Section 11 53 43 and details on Laboratory Furnishings drawings for service fittings. P-trap, waste piping and tailpiece extensions for cup sinks, if required, shall be furnished and installed by Division 22. Comply with Division 22 requirements for piping and installation requirements.
 - 2. Pre-wire all electrical devices to junction box at top of hood. Provide wire terminal blocks and terminal identification. Comply with Division 26 requirements for electrical work. Lighting fixtures, electrical outlets, switches, wiring, terminal blocks, terminal boxes, safety alarms and other electrical devices mounted on or in fume hoods shall be approved for use in any Class 1, Division 2 locations indicated on the drawings.
 - 3. Work of this Section requires close coordination with Work of Divisions 22, 23, 25 and 26, as well as installation of Laboratory 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.
- C. Exhaust Requirements:
 - 1. Refer to Fume Hood Schedule for requirements.
 - 2. Fume hoods and exhaust devices shall be designed to operate safely within the values provided on the Fume Hood Schedule. The airflow values provided on the Fume Hood Schedule represent the total airflow through the fume hood or exhaust device, including the airflow through the sash or work opening, airfoil, bypass, and leakage, respectively, as they apply to particular devices. Exhaust devices shall operate at specified face velocity within total airflow scheduled.
 - 3. Proposed modifications or corrections shall be reviewed and approved by Laboratory Planner and Mechanical Engineer for any device that requires adjustment to operate within specified design requirements.

1.5 REFERENCES

- A. ASHRAE 110, latest edition, Method of Testing Performance of Fume Hoods.
- B. Work shall conform to the recommended practices of the Scientific Equipment and Furniture Association (SEFA), current version, except as superseded by this specification:
 - 1. SEFA 1 - Fume Hoods.
 - 2. SEFA 2 - Installation.
 - 3. SEFA 3 - Laboratory Work Surfaces.
 - 4. SEFA 7 - Fixtures.
 - 5. SEFA 8 M - Laboratory Grade Metal Casework.
 - 6. SEFA 8 P - Laboratory Grade Polypropylene Casework.
- C. Occupational Safety and Health Administration, Federal Register 29 CFR Part 1910.1450, "Occupational Exposures to Hazardous Chemicals in Laboratories."
- D. American National Standards Institute/American Industrial Hygiene Association (ANSI/AIHA) Z9.5 "Standard for Laboratory Ventilation."
- E. National Fire Protection Association (NFPA) 45 "Standard on Fire Protection for Laboratories Using Chemicals."
- F. American Conference of Government Industrial Hygienists (ACGIH) "Industrial Ventilation."

1.6 SUBMITTALS WITH PROPOSAL

- A. Description of hoods, including construction details, materials, gauges, sash lock and release procedure, hardware cut sheets, piping of equipment and description of re-lamping procedures.
- B. Statement giving face velocity, operating volume and pressure drop at operating sash position for each size hood.
- C. Description of proposed factory dynamic testing procedures.

1.7 SUBMITTALS

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, fan curves, test designs, performance charts, and products for Work specified in this Section.
- C. Shop Drawings:
 - 1. Submit complete shop fabrication and installation drawings, including plans, elevations, sections, dimensions, materials and metal gauge sizes, details, fittings, duct connections, schedules, and steam table piping and vents from cabinets below where applicable. Show relationship to adjoining materials and construction. Identify all connection points, locations and sizes to building services and systems. Provide clear identification where equipment requirements deviate from the service/utility provisions in the Construction Documents. Shop Drawings shall be in the form of reproducibles or photocopies, not to exceed 11 IN by 17 IN in size. Blue-line prints are not acceptable.
 - 2. Coordinate shop drawing submittals of both this Section and Section 12 35 53 so that each recognizes and incorporates each others products.
- D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements.
 - 1. Fume hoods shall be designed and anchored in accordance with IBC 2000 Seismic Design Category C requirements.
- E. Samples: Submit two (2) samples of each type of specified finish and color range available, or as identified in the Finish Schedule.

- F. Certification: Submit certification by an independent testing company stating that equipment is installed per applicable and referenced codes and standards, adjusted and balanced for design operations, and is complete and ready for intended function.
 - 1. Certify that fume hoods will not exceed design maximum at specified operating conditions.
- G. “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 at 60 fpm face velocity at operating sash opening.
- H. Fume Hood Sound Level Certification: Provide certification of fume hood compliance with design criteria for maximum allowable noise within laboratories.
 - 1. For fume hoods operating with a face velocity of 80 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 IN in front of open sash, 60 IN above the floor, at 80 fpm face velocity.
- I. Informational Submittals:
 - 1. Provide piping, wiring, and/or control diagrams, including all connection points and sizes to building services and systems. Provide flow rates, pressure drops, voltage and amperage, etc.
- J. Closeout Submittals:
 - 1. Operations/Maintenance Manuals: Accompanying certification, submit for Architect’s review and Laboratory’s use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, wiring diagrams, and closest factory representative for components and service.

1.8 QUALITY ASSURANCE

- A. Coordinate work of this Section with Section 12 35 53 Laboratory Casework and Furnishings.
- B. Provide interface products of style, material, finish, and color in order to produce a homogenous installation.
- C. Fume Hoods shall be UL tested and labeled and conform to Class A requirements of ANSI Z9.5 Laboratory Ventilation.

1.9 QUALIFICATIONS

- A. Fume Hood Manufacturer:
 - 1. Work in this Section shall be manufactured 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.
 - 2. Manufacturer shall maintain a factory test facility which provides variable exhaust and make-up air control. Test facility shall contain, as permanent equipment, ANSI/ASHRAE 110 testing equipment as specified for performance testing.

PART 2 - PRODUCTS

2.1 CHEMICAL FUME HOODS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All chemical fume hoods shall be the product of a single manufacturer.
 - 1. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121. website: <http://www.hamiltonlab.com/>

2. Labconco Corporation. 8811 Prospect Avenue, Kansas City, MO 64132-2696 Tel: 800-821-5525. website:www.labconco.com
 3. Mott Manufacturing Limited. 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825. website: <http://www.mott.ca>
 4. LabCrafters, 2085 Fifth Avenue, Ronkonkoma, NY 11779, Tel:631 471-7755. website: <http://www.lab-crafters.com/>
 5. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202. - website: <http://www.kewaunee.com/>
 6. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728, Tel: 800 711-5227. – website: <http://www.alc-corp.com>
 7. Substitutions are permitted subject to Section 01 63 00.
- 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. Recycled Steel Content: A minimum of 20 percent of the steel used in the fabrication of laboratory cabinets, fume hoods and modular laboratory systems shall consist of the sum of post-consumer recycled content plus one-half of the pre-consumer content, based on the cost of the total value of materials.
 - B. ASTM A366 high quality, cold rolled, mild steel, and free from rust, scale, scratches, buckles, ragged edges, and other defects.
 - C. Minimum Thickness: 18 gauge.
 2. Stainless Steel:
 - A. Recycled Steel Content: A minimum of 20 percent of the stainless steel used in the fabrication of laboratory cabinets, fume hoods and modular laboratory systems shall consist of the sum of post-consumer recycled content plus one-half of the pre-consumer content, based on the cost of the total value of materials.
 - B. Type 304, ASTM 240, with exposed surfaces ground and polished to a No. 4 finish.
 - C. Minimum Thickness: 16 gauge.
 - D. 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 IN; baffle thickness: 1/4 IN, minimum. Liner performance characteristics shall be as specified below.
 - B. For Stainless Steel Hood Liner as noted on the drawings: 16 gauge Type 304 stainless steel. Continuously weld liner top to sides; grind welds smooth. Radius all vertical corners 1/2 IN.
 4. Glass: 7/32 IN 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. Safety glass shall be in compliance with ANSI Z97.1.
 5. Sash Guides: Extruded PVC.
 6. Sash pull: Full width corrosion-resistant steel with chemical resistant powder coating, stainless steel, or plastic.
 7. Gaskets: White 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood.
 8. Fasteners:
 - A. Exterior structural member attachments: Sheet metal screws, zinc plated.

- B. Exposed exterior fastening devices shall be corrosion-resistant, non-metallic material; exposed screws are not acceptable.
 - C. Interior fastening devices: Except where specifically allowed by this Specification, interior fastening devices shall be concealed; exposed screws are not acceptable. (Screw head "caps" not acceptable.)
9. Instruction Plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information addressing the recommended locations for apparatus and accessories, baffle settings, if adjustable, and use of sash.
- D. Construction:
1. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4 7/8 IN thick. Wall shall consist of a sheet steel outer shell and a corrosion resistant inner liner, and shall house and conceal steel framing members, piping, wiring, attaching brackets, and remote operating service fixture mechanisms and services. Panels shall be attached to a full frame construction, minimum 14 gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracketry from hood interior. Front panels shall be factory-punched for service fittings, electrical, control, and monitoring equipment. Provide stainless steel or epoxy- or urethane-coated plug buttons for holes not used.
 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 fitted gasket, tamperproof, epoxy- or urethane-coated, countersunk, flat head screws, or similar method, providing a tight fit. Hook and loop type attachments and panels held by gravity are not acceptable.
 3. Baffle Adjustment: In standard chemical fume hoods, if adjustable baffles are provided, the adjustment control shall be operable from outside the hood without exposing the user to the hood interior environment and, for ADA compliant hoods, shall be within the reach of a wheel chair bound operator. All baffles, supports, and brackets to be non-metallic. Baffles may be made fixed. Baffles shall be removable for cleaning.
 4. Baffles: In high performance/low velocity fume hoods, baffles shall be fixed and non-adjustable. Baffles shall be removable for cleaning.
 5. Ceiling Closure Panels: Provide 18 gauge steel paneled enclosure from top of hood to the ceiling. Enclosure shall include hinged door to access hood lighting fixture, and HEPA filter module where applicable. Finish shall match superstructure exterior. Panels shall terminate 1/4 IN below finished ceiling, where provided, or at 9'-0" above finished floor where there is no finished ceiling.
 6. Bypass Grill: In standard fume hoods low-resistant type 18 gauge (1.27mm) steel with upward directional louvers. Alternative bypass solutions are acceptable; manufacturer shall notify Contractor and Architect/Engineer/Laboratory Planner of alternative solutions and verify solution is coordinated.
 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:
 - A. Provide contoured 20 gauge (7.1mm) exhaust collar and transition piece, if necessary, to receive circular exhaust duct connection by Division 23. Collar and transition piece shall receive urethane powder coating. Collar shall include duct transition if collar diameter is less than the duct diameter indicated on the HVAC ductwork drawings. Collar shall be stainless steel if hood has stainless steel liner.
 - B. Every hood to have combination exhaust collar 13-1/2 IN high
 10. Exhaust Filter Pack Assembly:
 - A. All hoods designated as HEPA on the plans should be provided with a replaceable bag-in/bag-out HEPA filter pack assembly located in the exhaust duct.
 - B. HEPA filter shall be properly seated in the filter housing preventing any nanomaterial to bypass the filter.

- C. HEPA filter, filter seating, gaskets and seal must conform to all standards and requirements as in DOE Standard; *Specifications for HEPA Filters Used by DOE Contractors*, DOE-STD-3020-97.
 - D. Provide access panel in ceiling enclosure panel to easily change out filter below ceiling.
 - E. Provide 99.99% efficient bagout HEPA filter.
11. Cup Sink:
 - A. Oval with raised rim (CS-1), material and color to match work surface, sizes in accordance with drawings. Comply with Section 11 53 43 requirements.
 - B. For stainless steel fume hood work surfaces, oval stainless steel cup sink integral with work surface with raised rim, size in accordance with drawings. Comply with Section 11 53 43 requirements.
 - C. Raised Rim Height: 1/4 IN.
 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 11 53 43, factory-installed and complete with all gaskets, grommets and sleeves.
 14. Alarm and Controls: Coordinate cut outs for fume hood alarm and controls to be provided under Division 25. All cut outs for alarm and controls shall be made in the factory; field cutting is not acceptable.
 15. Electrical Receptacles:
 - A. Flush mounting, 120V/20A duplex type, single gang, NEMA 5-20R, 3-wire, grounding type receptacle, one per side, or as indicated on the Fume Hood Schedule, with brushed stainless steel cover plate.
 - B. Flush mounting, 208V/20A single gang, NEMA 6-20R, 3-wire, grounding type receptacle, as indicated on the Fume Hood Schedule, with brushed stainless steel cover plate.
 - C. Color: Receptacles shall be brown with hoods painted dark colors and white for hoods painted white, off white, grey, yellow, or similar colors.
 - D. Interior Receptacles: Factory install flush mount GFCI receptacles on the interior fume hood wall as noted on the Fume Hood Schedule. Receptacles must have a self closing cover plate. Receptacle must have a power kill switch mounted on the fume hood post and clearly labeled as such. This system must be included in the manufacturer's UL 1805 file and approved by UL.
 16. Interior Hood Lighting:
 - A. Lighting within hood shall be provided by a protected fluorescent lighting fixture with two lamps (32W T8, electronic ballast, rapid start) operated by an exterior switch with stainless steel cover plate located on the face of the fume hood. Lamp size shall not exceed 48 IN; provide multiple fixtures as required.
 - B. Provide safety glass panel cemented and vapor-tight sealed to the hood roof.
 - C. Light level: Average light level on the work surface shall be 80 footcandles, minimum.
 - D. Relamping shall be achieved from outside the hood enclosure.
 - E. Light fixture shall be U.L. listed.
 - F. Color: Switch shall be brown with hoods painted dark colors and white for hoods painted white, off white, grey, yellow, or similar colors.
 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 80 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: Fume hood finish shall comply with SEFA 8 M Cabinet Surface Finish performance requirements.
 19. Exterior Color: As selected by Architect from manufacturer's full color line and complying with finish requirements.
 20. Through Port: 4 IN inside diameter (or as noted on drawings) threaded polypropylene or polyolefin sleeve with threaded pipe flanges and end caps. Provide rubber membrane inside each end cap with radiating cuts to allow for easy passage of cords and tubing.

- E. High Performance/Low Velocity Chemical Fume Hoods:
1. Basis of Design: Hamilton Products, a part of Thermo Fisher Scientific, Concept Hood, or equal, as specified herein.
 2. Drawing Designations:
 - A. 4 FT benchtop: CFH48HV-xx
 - B. 5 FT benchtop: CFH60HV-xx
 - C. 6 FT benchtop: CFH72HV-xx
 - D. 8 FT benchtop: CFH96HV-xx
 3. Depth: See Fume Hood Schedule.
 4. 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 percent 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 percent 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 between 60 feet per minute (0.30 m/s) and 100 feet per minute (0.51 m/s).
 5. Work Surface: 1-1/4 IN dished epoxy resin, as in compliance with Section 12 35 53 requirements. Color: Black. See Fume Hood Schedule
 6. Work Surface: Stainless steel with seamless die-formed 1/2 inch (13mm) marine edge, in compliance with Section 12 35 53 requirements. See Fume Hood Schedule.
 7. Downdraft bypass: Low resistant type, 18 gauge 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.
 8. 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 IN 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.
 9. Fume hood sash (Vertical) for fume hoods less than 5'-0" wide: 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 (890mm), nominal, sight line and a 28-1/2 inch (724mm), nominal, vertical access height.
 10. Fume hood sash (Combination horizontal/vertical) for fume hoods 5'-0" wide or larger: Provide vertical and horizontal sash access with a 35 inch (890mm), nominal, high sight line. Sash shall be top hung on nylon tired stainless steel ball bearing wheels. Sash frame on bottom and sides must be no more than 1-1/2 inch (38mm) thick and radiused to minimize turbulence. Area above the 28-1/2 inch (724mm), nominal, vertical sash opening shall be glazed with a minimum of 3/8 inch (9.53mm) thick laminated safety glass. All glass to have polished exposed edge treatment. Horizontal panels provided with finger pulls.
 11. Counter balance system: Single weight, sprocket and chain, counter balance system to prevent sash tilting and permit ease of operation at any point along full width pull. Maximum 7 pounds 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 chain failure. Sash shall open and close against rubber bumper stops.
 - A. Sash shall have the capability to be raised to full 28-1/2 IN, nominal, vertical opening for loading or unloading of large apparatus.

12. Automatic Sash Operator: Vertical Sash shall lower automatically to the operating position when released from any position above 18 IN.
 13. Sash Stop: Rubber bumper stops to allow manual override with automatic reset for an 18 inch (457mm) sash opening.
- F. High Performance/Low Velocity Floor-Mounted Fume Hoods:
1. Basis of Design: Hamilton Products, a part of Thermo Fisher Scientific, Concept Hood, or equal, as specified herein.
 2. Drawing Designations:
 - A. 6 FT floor-mounted: FMFH72-xx
 - B. 8 FT floor-mounted: FMFH96-xx
 3. Depth: See Fume Hood Schedule.
 4. 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 percent 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 percent 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 between 60 feet per minute (0.30 m/s) and 100 feet per minute (0.51 m/s).
 5. Downdraft bypass: Low resistant type, 18 gauge 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.
 6. Fume hood sash (Combination horizontal/vertical): Provide double-hung, vertical sash with a 66-1/2 inch (1689mm), nominal, high sight line. Upper sash shall be provided with horizontal sash access. Horizontal sash shall be top hung on nylon tired stainless steel ball bearing wheels. Sash frame on bottom and sides must be no more than 1-1/2 inch (38mm) thick and radiused to minimize turbulence. Area above the 28-1/2 inch (724mm), nominal, vertical sash opening shall be glazed with a minimum of 3/8 inch (9.53mm) thick laminated safety glass. All glass to have polished exposed edge treatment. Horizontal panels provided with finger pulls.
 7. Counter balance system: Single weight, sprocket and chain, counter balance system to prevent sash tilting and permit ease of operation at any point along full width pull. Maximum 7 pounds 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 chain failure. Sash shall open and close against rubber bumper stops.
 - A. Sash shall have the capability to be raised to full 77 IN, nominal, vertical opening for loading or unloading of large apparatus.
 - B. Sash shall lower automatically to the operating position when released from any position above 66-1/2 IN.
 8. Automatic Sash Operator: Vertical sash shall lower automatically to the operating position when released from any position above 18 inches (457mm).
 9. Sash Stop: Rubber bumper stops to allow manual override with automatic reset for an 18 inch (457mm) sash opening.
 10. Fume Hood Floor: Provide black epoxy resin fume hood floor with raised lip at sash opening. Lip shall have chamfered corners.
- G. Fume Hood Liner Test: Polyresin
1. Test No. 1: Spills and Splashes:
 - A. Suspend a 42 IN by 12 IN panel (42 IN dimension horizontal) in a position to expose the surface to be tested in a vertical plane. Divide the panel vertically into 3/4 IN 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 IN by 12 IN by dividing panel into 2 IN squares. Using 100 ml beakers, place 25 ml (approximately 1/2 IN 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		1	0
Acid dichromate		1	0
Ammonium hydroxide	28%	0	0
Amyl acetate		1	0
Benzene		1	0
Butyl alcohol		0	0
Carbon tetrachloride		0	0
Chloroform		1	0
Chromic acid, saturated		2	0
Cresol		1	0
Dichloro acetic acid	93%	1	1
Dimethyl formamide		1	0
Dioxane		0	0
Ethyl acetate		0	0
Ethyl alcohol		0	0
Ethyl ether		1	0
Formaldehyde	37%	0	0
Formic Acid	88%	0	0
Furfural		3	0
Gasoline		1	0
Hydrochloric acid	37%	0	1
Hydrofluoric acid	48%	0	4
Hydrogen peroxide	30%	0	0
Methyl alcohol		0	0
Methyl ethyl ketone		1	0
Methylene chloride		0	0
Monochlorobenzene		1	0
Naphthalene		1	0

Reagent	% by wt.	Spills	Fumes
Nitric acid	20%	1	0
Nitric acid	30%	1	0
Nitric acid	70%	1	0
Phenol	85%	0	1
Phosphoric acid	85%	0	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	0
Sulfuric acid	33%	0	0
Sulfuric acid	77%	1	0
Sulfuric acid	93%	2	0
Sulfuric acid/Nitric acid, equal parts	77%/70%	0	1
Tincture of Iodine		1	1
Trichloroethylene		1	0
Toluene		1	0
Xylene		1	0
Zinc Chloride		0	0

Note: Maximum concentration is to be understood unless a lower concentration is shown in the table.

2.2 FUME EXTRACTOR ARMS (SNORKELS)

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All snorkel fume extractors shall be the product of a single manufacturer.
1. Nederman Inc., 39115 West Warren Road, Westland, MI 48185, Tel: 800-575-0609.
 2. Plymovent Corporation, 375 Raritan Center Parkway, Edison, NJ 08837, Tel: 800-644-0911.
 3. Airflow Systems, Inc., 11370 Pagemill Road, Dallas, TX 75243, Tel: 214 503-8008.
 4. Enviroflex International Inc., 1051 Clinton St., Buffalo, NY 14206, Tel: 716 883-2319.
 5. Alsident System, distributed by Laboratory Enterprises, Inc., 100 E. Quindaro Boulevard, Kansas City, KS 66115, Tel: 262 628-0047.
 6. Movex Inc., 7289 Park Drive, Bath, PA 18014, Tel: 610 440-0478.
 7. Substitutions are permitted subject to Section 01 63 00.
- B. Basis of design: Nederman FX Original Extraction Arm 100 (6A). 4 IN hose diameter, hinged, self-supporting air extractor arm assembly, or equivalent (part no. 70570544).
1. Arm shall consist of 360 degree swivel elbow, support flange, internal support, pre-set joints with adjustable wear discs, anodized aluminum arm, hood, and flange for 4 IN exhaust duct.
 2. Fume extractor shall be constant volume device with manual damper.
 3. Mounting Bracket: Ceiling bracket. Use vibration secured fixing bolts and nuts suitable for structural ceiling mounting.
 4. Bracket Support: Provide extension arm or slotted channel framing as required to suspend and support ceiling bracket from structure above.
 5. Ceiling Cover Plate: Provide ceiling enclosure plate at ceiling.
 6. Mounting Height: Mount the Extraction Arm so that the lowest point of the assembly when retracted is 6 FT – 8 IN a.f.f. Provide wall bracket as required to brace ceiling hung extractor arm
 7. Arm Length: 94 IN.
 8. Silencer.
 9. Combination hood.

- C. Basis of Design: Nederman NEX HD Fume Extractor Arm (6C). 8 inch (203mm) hose diameter with separate, hinged support arm, to create self-supporting air extractor arm assembly, or approved equal, satisfying the identified requirements, characteristics, and features as specified herein:
1. Extraction arm shall be designed for high extraction capacity and heat resistance.
 2. Support arm shall consist of balanced, horizontally rotating swivel, horizontally pivoted boom, and vertically pivoted supporting arm.
 3. Hose shall be PVC on polyester fabric with steel helix reinforcement.
 4. Provide protective grille to prevent objects from being drawn into arm.
 5. Fume extractor shall be a constant volume device with manual damper.
 6. Mounting Bracket: Provide wall bracket. Extractor arm shall rotate 180 degrees.
 7. Bracket Support: Provide slotted channel framing as required to suspend and support ceiling bracket from structure above.
 8. Arm Length:
 - a. 9 feet 10-1/8 inches (3m).
 9. Rectangular aluminum hood flange with protection grille.
 10. Spark screen.
 11. Hood light, including switch and transformer, if required; UL listed.

2.3 CUSTOM VENTILATED ENCLOSURE

- A. Description: Floor mounted exhaust enclosure for ventilation of odors and heat from stacked box furnaces on perforated stainless steel shelves or other equipment. Enclosure should be designed per requirements shown on Fume Hood Schedule.
- B. Construction:
1. Enclosure shall be constructed to withstand laboratory use, and will be designed in accordance to guidance from user and architect.
- C. Features:
1. Dimensions: exterior dimensions per requirements shown on Fume Hood Schedule.
 2. Electrical Receptacles: per requirements shown on Fume Hood Schedule.
 3. Fixtures: per requirements shown on Fume Hood Schedule.

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 Divisions 22, 23, 25 and 26, as well as installation by Laboratory of Laboratory 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 manufacturer's written instructions, applicable codes and regulations, accepted Shop Drawings, and as necessary for a complete operating system.

- D. Install equipment plumb, square, and straight with no distortion and securely anchored, as required.
- E. Coordinate with Section 12 35 53 for venting corrosives storage cabinets behind rear baffle of fume hood.

3.3 FIELD TESTING: CHEMICAL FUME HOODS

- A. Provide two week advance notice of scheduled testing.
- B. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity and air flow patterns.
- C. 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.
 - 1. Fume hoods shall achieve an "As Installed" (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.
- D. Balancing of the system is in the scope of work of Division 23.
- E. Verify exhaust air quantity does not exceed design, plus allowable leakage.
- F. Verify hood pressure drop does not exceed design.
- G. Adjust and retest hoods that do not meet specified performance.
- H. Replace hoods which do not meet standards after repetitive testing.

3.4 ADJUSTING, 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 parts to function within their design parameters.

3.5 CLEANING

- A. Clean equipment, touch up as required.

3.6 DEMONSTRATION

- A. Videotape showing recommended operation and maintenance of each type of hood specified.

3.7 PROTECTION

- A. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.

END OF SECTION

SECTION 11 53 33
LASER SAFETY EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Laser Entry Control System.
- B. Laser Curtain and Track Assembly.

1.2 UNDIVIDED RESPONSIBILITY

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

1.3 REFERENCES

- A. ANSI Z136.1 Safe Use of Lasers, current edition.

1.4 DESCRIPTION

- A. Provide equipment complete with accessories as described herein and shown on Laboratory Furnishings drawings.
- B. Work of this Section requires close coordination with Work of Divisions 08, 09 and 26 as well as installation of Laboratory 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.
- C. Work includes, but is not limited to, furnishing to the project site for installation by Division 26, laser entry control system described herein and shown on the Laboratory Furnishings Drawings and Electrical Drawings.

1.5 SUBMITTALS

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, fan curves, test designs, performance charts, and products for Work specified in this Section.
- C. Submit complete shop fabrication and installation drawings for complete systems for each applicable room, including plans, elevations, sections, details, fittings, duct connections, and schedules. Show relationship to adjoining materials and construction. Identify all connection points, locations and sizes to building services and systems. Provide clear identification where equipment requirements deviate from the service/utility provisions identified in the Construction Documents. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 inches by 17 inches (A3) in size. Blue line prints are not acceptable.
- D. Informational Submittals: Provide wiring, and/or control diagrams, including all connection points and sizes to building services and systems. Provide voltage and amperage, etc.
- E. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and Laboratory's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, wiring diagrams, 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 five 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.

PART 2 - PRODUCTS

2.1 LASER ACCESS CONTROL SYSTEM

- 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. Kentek Corporation, 19 Depot Street, Pittsfield, NH 03263 Tel: 800 432-2323 website: <http://www.kentek-laser.com/>
 - 2. Rockwell Laser Industries, Inc., P.O. Box 43010, Cincinnati, OH 45243 Tel: 800 945-2737 website: <http://www.rli.com/>
 - 3. Substitutions are permitted subject to Section 01 63 00.
- B. Description: Microprocessor-based door, curtain and laser control system is used to control entry and egress, as well as laser emission to areas in which there is accessible and/or exposed laser energy and can be utilized as part of a system to meet the "Entryway System Controls" as specified by ANSI Z136.1, Part 4.3.10.2. System shall interlock doors and/or laser curtains with laser shutter or power.
 - 1. All lasers and shutters within a designated laser control area shall be controlled with a single key.
 - 2. System shall be of flexible design for easy application to most environments.
- C. Components: The system may include the following:
 - 1. Main Control Module: Module shall consist of wall-mounted painted metal enclosure with front-mounted controls and housing microprocessor controller. The module shall be used in conjunction with other components. Front panel controls shall include enclosure key lock, system power key switch, ENGAGE and EXIT buttons, and system status indicators, such as POWER ON, DOORS CLOSED, INTERLOCK ON, and EXIT NOW.
 - 2. Magnetic door locks.
 - 3. Entry keypads.
 - 4. Remote pushbuttons.
 - 5. Emergency access switches.
 - 6. Laser interlock or shutter.
 - 7. Illuminated safety signs.
 - A. Metal lighted sign box with translucent plastic warning signs. Signs shall be back-mounted or edge-mounted to best serve particular locations.
 - B. Illuminated signs shall be three-way and three color to indicate NO HAZARD - LASER OFF, BEAM CAUTION - LASER ENERGIZED, or DANGER - BEAMS ACCESSIBLE.
 - 8. Other necessary devices for a complete, functional system.
 - 9. Non-defeatable safety latches.
 - 10. Circuitry.
- D. System Design: Manufacturer shall design entry control system for each applicable room.

E. Features:

1. Emergency stop and external emergency access controls.
2. Four isolated, normally open relay closures for control of laser interlocks and shutters.
3. Three isolated Normally Open/Normally Closed auxiliary laser interlock relays.
4. Isolated magnetic door latch relay.
5. Universal interface to entry key cards, or dedicated key pads, etc.
6. Automated illuminated laser safety sign control.
7. Audible indicator for interlock timeout and exit delay (defeatable).
8. Adjustable exit delay, 5 to 90 seconds.
9. Automatic shutdown of lasers and unlocking of doors by building fire or evacuation alarm.
10. Automatic shutdown of lasers if access parameters are violated.
11. Optically isolated external inputs.
12. Three automatic warning sign modes.
13. Easy remote of system ENABLE and EXIT REQUEST controls.
14. External computer/access controller monitor interface.
15. Full function diagnostic indicators.
16. Built-in low voltage power supply.

2.2 LASER CURTAIN AND TRACK ASSEMBLY

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. Kentek Corporation, 19 Depot Street, Pittsfield, NH 03263 Tel: 800 432-2323 website: <http://www.kentek-laser.com/>
2. Rockwell Laser Industries, Inc., P.O. Box 43010, Cincinnati, OH 45243 Tel: 800 945-2737 website: <http://www.rli.com/>
3. Control Optics Corporation, 1311 Brooks Drive, Suite J, Baldwin Park, CA 91706 Tel: 626 813-1991 website: <http://www.controloptics.com/>
4. Wilson Laser Safety Products, Pomona, CA Tel: 909 468-3636 website: <http://www.wilsonindustries.com/>
5. Substitutions are permitted subject to Section 01 63 00.

B. Performance:

1. The laser curtain shall afford the required level of protection from direct and diffusely scattered laser light.
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 seconds.
3. No part of the installation shall release toxic fumes following a laser exposure.
4. Fabric:
 - A. Curtain must be flame-retardant or made of non-combustible materials. Fabric must pass the flame resistance requirements specified by the State of California test, and be in accordance with the National Fire Protection Association Standard No. 701-2010 test methods 1 and 2. Submit certificate of passage to tests.
 - B. Curtain material shall be appropriate for the laser(s) to be used. Refer to Laser Curtain Schedule at the end of this Section.
 - C. The curtain material shall comply with all laser, fire, and smoke testing requirements for use in laser protection areas. The curtain material shall be resistant to abrasion, flexing, tear, and puncture. In addition, the material shall be water and oil resistant.
5. The curtain shall be sewn flat with 10 percent fullness. The seams shall be sewn French-style (no raw edges visible). The curtain top shall have brass grommets on 8 IN centers. Provide a heavy gauge fabric-reinforcing strip inserted in the top hem to provide addition strength for the insertion of grommets. The bottom edge shall be weighted and held a quarter inch above the finished floor. All sewing shall be done in a manner so that fabric is not pierced in a way that will allow light through the needle holes.

6. The outside vertical edges shall be supplied with "Velcro" quick-seal strips to facilitate "light-trap" overlaps for easy light-tight attachment to walls.
- C. Track Material and Assembly:
1. Construct of satin anodized extruded aluminum box-channel 1-3/8 IN x 3/4 IN slotted on the underside to receive two wheeled carriers designed for surface mounting to the underside of the ceiling. Supply track with hook carriers, end-caps, snap-outs, and connectors, of the sleeve type. Hooks are formed of rustproof wire and bead chain riding on a carrier with non-wearing nylon wheels. Corners, where required, shall be one-piece, 26 IN radius 90 degree track sections.
 2. Curtain Supplier/Installer must provide any bracing necessary at ceiling. Coordinate with ceiling Manufacturer/Installer.

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 LASER CURTAIN INSTALLATION

- A. Installation of laser curtain shall be performed by installers experienced in the installation of the respective item as determined by the respective manufacturer.
- B. The laser curtain and track assembly shall be installed to prevent laser light from exiting the laser controlled area at levels above the applicable MPE level.
- C. Curtain Supplier/Installer must provide any bracing necessary at ceiling. Coordinate with ceiling Manufacturer/Installer.

3.3 LASER ENTRY CONTROL SYSTEM INSTALLATION

- A. Provide all necessary components for a complete operating system.
- B. Entry control system wiring shall be installed under scope of work of Division 26.

3.4 CLEANING

- 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.

3.5 DEMONSTRATION AND INSTRUCTION

- A. Refer to Section 01 79 00.
- B. Test equipment prior to demonstration. Ensure equipment, including specified accessories, is operational.
- C. Provide demonstration of equipment operation and instruction of Laboratory's personnel.

- D. Demonstrate operating capability of equipment and systems. Include control and safety features, and service and maintenance procedures.
- E. Engage services of qualified instructor to instruct and train Laboratory's operating and maintenance personnel in operation, service, and maintenance of equipment. Provide at least four hours of instruction for each type of equipment.

3.6 PROTECTION

- A. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.

END OF SECTION

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SECTION 11 53 43
LABORATORY SERVICE FITTINGS AND FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Laboratory service fittings, valves, electrical pedestal boxes, and related components.
- B. Laboratory emergency plumbing fixtures.
- C. Laboratory sinks.

1.2 UNDIVIDED RESPONSIBILITY

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

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-: Fixtures, current version.
- B. All emergency plumbing fixtures shall comply with requirements of ANSI Standard Z358.1-2004: American National Standard for Emergency Eyewash and Shower Equipment.
- C. Where identified, service fittings and sinks shall be accessible to the disabled in compliance with the requirements of the federal Americans with Disabilities Act (ADA), ADA Accessibility Guidelines (ADAAG), and state accessibility regulations.
- D. All emergency plumbing fixtures shall be accessible to the disabled in compliance with the requirements of the federal Americans with Disabilities Act (ADA), ADA Accessibility Guidelines (ADAAG), and state accessibility regulations.

1.4 DESCRIPTION

- A. Work includes but is not necessarily limited to furnishing to the project site for installation by Division 22, all laboratory fittings, emergency plumbing fixtures, and fixtures described herein and shown on the Laboratory Furnishings Drawings. When specified, Division 26 shall install associated electrical work associated with emergency equipment.

1.5 SUBMITTALS

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for Work in this Section.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, dimensions, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducibles or photocopies, not to exceed 11IN by 17 IN in size. Blueline prints are not acceptable.
- D. Samples: Submit two (2) samples of each type of specified finish and color specified.
- E. Operations/Maintenance Manuals: Submit under provisions of Section 01 77 00 complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and nearest local factory representative for components and repairs.

1.6 QUALIFICATIONS

- A. Work of this Section shall be performed by an organization with five years documented experience specializing in the manufacture of the type of equipment specified, with demonstrated ability to produce the specified equipment of the required quality and quantity for complete installation in a project of this type and size within the required time limits.
- B. Work in this Section requires close coordination with Work in Section 12 35 53, Division 22 Plumbing, Division 23 HVAC and Division 26 Electrical. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- 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.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All service fittings and emergency plumbing fixtures shall be specifically designed for laboratory use.
- B. All service fittings and emergency plumbing fixtures shall be factory pre-assembled including the assembly of valves to turrets, mounting shanks to turrets, etc., and individually factory tested.
- C. All laboratory service fittings shall be the product of one service fitting manufacturer to assure ease of replacement and maintenance.
- D. All emergency plumbing fixtures shall be the product of one 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 percent, except for items which are to be brass forging or bar stock, or are specifically specified to be of another material.
- F. Provide fittings at locations indicated on the Laboratory Furnishings drawings. Refer to Laboratory Fixture and Fitting Schedule for types.
- 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 IN IPS thread with the hose end being tapered. Diameter of orifice in serrated tip shall be 1/8 IN, 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 IN 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 IN 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 at turret 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 vacuum breakers for all hot and cold water fittings including water fittings at fume hoods.
- R. Provide plug and socket (2-piece) quick connect service fittings, as manufactured by Swagelok Company website: <http://www.swagelok.com/> tel: 440 248-4600., Hansen Manufacturing (Air-Oil Systems, Inc.) website: <http://www.airoil.com/> tel: 800 333-5520., or Tomco Products, Inc. website: <http://www.tomcoquickcouplers.com/> tel: 864 574-7966, or as manufactured by the remainder of the laboratory fittings, for all chilled water supply and return fittings and compressed air (AIR60) fittings and all other specialty gas fittings at ceiling service panel locations over the movable benches.
- S. Fittings and fixtures designated to be accessible to the disabled (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, maximum.

2.2 LABORATORY SERVICE FITTINGS

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory service fittings specified in this section shall be provided by a single manufacturer.
 - 1. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: 312 666-5500. website: <http://www.wsflab.com/>.
 - 2. T&S Brass and Bronze Works, Inc., 2 Saddleback Cove, P. O. Box 1088, Travelers Rest, SC 29690 Tel: (800) 476-4103. - website: <http://www.tsbrass.com/>.
 - 3. The Chicago Faucet Company, 2100 S. Clearwater Dr., Des Plaines, IL 60018-5999 Tel: 847-803-5000. website: <http://www.chicagofaucets.com>
 Substitutions are permitted subject to Section 01 63 00.
- B. Body Style: All service fittings shall have traditional body profiles (cylindrical and tapered). Mushroom-profile body styles are not allowed. Turrets shall be provided without deck flanges.
- C. Handles:
 - 1. Faucets designated to be accessible to the disabled (ADA): provide "wrist-blade" handles with screw on index (identification) discs.
 - 2. Laboratory gas, air and vacuum valves at workstations indicated to be accessible to the disabled (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: Polished chrome, with clear, acid-resistant (epoxy) 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. All water service fixtures shall satisfy the requirements of ANSI/ASME A 112.18.1M-1989 and be certified by the Canadian Standards Association (CSA) under Standard CAN/CSA B.125.M89.
 5. Water fixtures shall be fully assembled and factory tested at 80 psi water pressure.
 6. See Laboratory Fixture and Fitting Schedule on drawings for model and type of fixture.
 7. HCW-4: Bench-mounted, hot and cold water faucet: Water Saver L2221AC-VB, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Wrist blade handles with colored plastic index buttons.
 - C. Renewable water valves and deck-mounted valve body.
 - D. Swing vacuum breaker gooseneck with 8 inch (203mm) spread.
 - E. Removable aerator.
 - F. Threaded mounting with locknut, washer, and coupling nuts.
 - G. Adjustable volume control.
 - H. Accessible to the disabled.
 8. HCW-9: Bench- or deck-mounted, hot and cold water pre-rinse unit: Water Saver PR411-110, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
 - B. Deck-mounted cast brass valve body with riser and valve hook.
 - C. 4" (102mm) wrist blade handle.
 - D. Adjustable wall support bracket.
 - E. 39 inch (990mm) flexible stainless steel hose.
 - F. Self-closing valve with insulated handle, locking ring, and rubber-bound, spray-type outlet head.
 - G. Mounting shank.
 - H. In-line vacuum breaker
 9. CW-1: Bench-mounted, single service faucet: Water Saver L611AC-VB, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Four-arm handle with colored plastic index button.
 - C. Renewable water valve and valve body.
 - D. Rigid vacuum breaker gooseneck with 6 inch (152mm) spread.
 - E. Serrated hose end. Hose end should be 5-7/8 inches (149mm) above deck.
 - F. Threaded mounting with locknut, washer, and coupling nut.
 - G. Adjustable volume control.
 9. PCWS-5; PCWR-5; PCWS-s; PCWR-s: Wall/panel-mounted/overhead service carrier, 1/2 IN ball valve for equipment cooling water: Water Saver L4301-159WSA, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Lever handle with colored plastic index button.
 - C. 1/2 IN IPS female inlet.
 - D. Wall flange.
 - E. Mounting shank.
 - F. Length of valve and quick connect fitting shall be 4-7/8 IN, nominal.

10. PCWS-1; PCWR-1: Deck-mounted, Turret base with ½ IN ball valve for equipment cooling water: WaterSaver L4301-121WSA, or approved equal as specified herein.
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Lever handle with colored plastic index button.
 - C. 1/2 IN IPS female inlet.
 - D. Mounting shank.
 11. CW-h: Fume hood-mounted, remote control, laboratory water valve for water service: Water Saver L739xW-L135WSA-BO358B-VB or L740xW-L135WSA-BO358B-VB, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
 - B. Panel-mounted valve.
 - C. Four-arm handle with colored plastic index button.
 - D. Locking ring.
 - E. Forged brass valve body located behind panel at front of hood.
 - F. Epoxy coated, panel-mounted turret base with serrated hose end.
 - G. Adjustable volume control fitting with hex wrench knob to be attached between turret base and serrated hose end.
 - H. Atmospheric vacuum breaker for panel mounting, mounted at top or front of fume hood enclosure.
 - I. Mounting shank.
 - J. End of serrated hose end shall be 2-3/4 inches (70mm), nominal, from turret centerline. Centerline of serrated hose end shall be 2-1/16 inches (52mm), nominal, from panel. Handle shall be 2-3/4 inches (70mm) long from panel to index button.
 12. PCWS-h: Fume hood-mounted, remote control, laboratory water valve for straight front fume hood with panel mounted 90 degree angle outlet fitting, serrated hose end and mounting shank: Water Saver L740W-5, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
 - B. Rod-type remote control valve.
 - C. Four-arm handle with colored plastic index button.
 - D. 3/8 inch (9.5 mm) aluminum rod with brass coupling.
 - E. Epoxy coated, panel-mounted turret base.
 - F. Adjustable volume control fitting with hex wrench knob.
 - G. Mounting shank.
 - H. Fixture shall satisfy requirements for accessibility of the disabled.
 13. PCWR-h: Fume hood-mounted, remote control, laboratory water valve for straight front fume hood panel mounted 45 degree angle outlet fitting and mounting shank: WaterSaver L740W-LR, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
 - B. Rod-type remote control valve.
 - C. Four-arm handle with colored plastic index button.
 - D. 3/8 inch (9.5 mm) aluminum rod with brass coupling.
 - E. Epoxy coated, panel-mounted turret base.
 - F. Adjustable volume control fitting with hex wrench knob.
 - G. Mounting shank.
 - H. Fixture shall satisfy requirements for accessibility of the disabled.
- F. High Purity Water Valves: Suitable for purified water and provided with polypropylene liner. Valve stem and bonnet shall be brass.
1. See Laboratory Fixture and Fitting Schedule on drawings for model and type of fixture.
 2. RO-1: Bench-mounted purified water fixture: Water Saver L7833SC, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. All components in contact with water shall be polypropylene.

- C. Forged brass valve body and 8 IN spread riser with polypropylene interior and lining.
 - D. Self-closing lever that can also be turned to operate in a stay-open mode.
 - E. Polypropylene serrated hose end.
 - F. Deck mounting flange.
 - G. Mounting shank.
 - H. End of serrated hose end shall be 7-7/8 IN, nominal, above bench top.
3. RO-2: Wall-mounted purified water fixture: Water Saver L7844-1/4, or approved equal, as specified herein:
- A. All components in contact with water shall be polypropylene.
 - B. Forged brass valve body, stem, and mounting shank.
 - C. Round black nylon handle with index button.
 - D. 1/4" NPT male outlet fitting.
 - E. Length of valve from wall to index button shall be 4 IN, nominal.
- G. Laboratory Ball Valves: Suitable for laboratory gas, air and vacuum and be supplied fully assembled and factory tested at 125 psi air pressure. Ball valves shall be of quarter-turn (closed to fully open) design, be fitted with lever handle requiring less than 5 lbf 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.
1. See Fixture and Fitting Schedule on drawings for model and type of fixture.
 2. UN2-1, CDA-1: Bench-mounted, single laboratory ball valve: Water Saver L4200-131WSA, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Lever handle with colored plastic index button.
 - C. Turret base.
 - D. Serrated hose end.
 - E. Mounting shank.
 - F. End of serrated hose end shall be 4-1/2 inches (114mm), nominal, from turret centerline. Centerline of serrated hose end shall be 2-1/16 inches (52mm), nominal, above bench top.
 - G. Fixture shall satisfy requirements for accessibility of the disabled.
 3. UN2-2, CDA-2: Bench-mounted, 180 degree straight dual laboratory ball valve: Water Saver L4200-132SWSA, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Lever handles with colored plastic index buttons.
 - C. Turret base.
 - D. Serrated hose ends.
 - E. Mounting shank.
 - F. End of serrated hose ends shall be 4-1/2 inches (114mm), nominal, from turret centerline. Centerline of serrated hose ends shall be 2-1/16 inches (52mm), nominal, above bench top.
 - G. Fixture shall satisfy requirements for accessibility of the disabled.
 4. UN2-5, CDA-5: Wall-mounted, laboratory ball valve: Water Saver L4200-158WSA, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Lever handle with colored plastic index button.
 - C. Forged brass wall mounting flange. Flange shall be threaded in a manner to be installed tight to wall surface in wall mounted applications, and allow fitting to be installed straight.
 - D. Serrated hose end.
 - E. Mounting shank.
 - F. End of serrated hose end shall be 4-7/8 inches (124mm), nominal, from wall.
 5. UN2-6, CDA-6: Wall-mounted, 90 degree angle dual laboratory ball valve: Water Saver L4200-146WSA, or approved equal, as specified herein:
 - A. Exposed metal shall be finished as specified elsewhere in this Section.

- B. Lever handle with colored plastic index button.
 - C. Forged brass wall mounting flange. Flange shall be threaded in a manner to be installed tight to wall surface in wall mounted applications, and allow fitting to be installed straight.
 - D. Serrated hose end.
 - E. Mounting shank.
 - F. End of serrated hose end shall be 4-7/8 inches (124mm), nominal, from wall.
6. UN2-s, CDA-s: Overhead service carrier-mounted, wye fitting with two angle pattern laboratory ball valves: Water Saver L4200-148-2SWS, or approved equal, as specified herein:
- A. Exposed metal shall be finished as specified elsewhere in this Section.
 - B. Lever handle with colored plastic index button.
 - C. Turret base
 - D. Mounting shank.
 - E. Length of valve from turret base to serrated hose ends shall be 5-3/8 inches (131mm), nominal.
7. UN2-h, CDA-h, SG1-h, SG2-h, SG3-h, SG4-h: Fume hood-mounted, remote control, laboratory ball valve for gas service: Water Saver L4285B-L122WSA, or approved equal, as specified herein:
- A. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
 - B. Rod-type remote control valve.
 - C. Lever handle with colored plastic index button.
 - D. Guide plate.
 - E. 3/8 inch (9.5mm) aluminum rod with brass coupling.
 - F. Panel-mounted, color epoxy coated outlet and flange with angled serrated hose end.
 - G. Mounting shank.
 - H. End of serrated hose end shall be 3-3/8 inches (86mm), nominal, from panel. Lever handle shall be 2-7/16 inches (62mm) from stem centerline to end.
 - I. Fixture shall satisfy requirements for accessibility of the disabled.

H. Service Fitting Color Index: for colored plastic index buttons:

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
Industrial Laboratory Cold Water	Dark Green	ICW	White
Industrial Laboratory Hot Water	Red	IHW	White
Cold Water (Potable)	Dark Green	CW	White
Hot Water (Potable)	Red	HW	White
High Purity Water	White	DI or RO	Black
Argon	Violet	AR	White
Nitrogen	Brown	N2	White
Carbon Dioxide	Pink	CO2	Black
Helium	Black	HE	White
Oxygen	Light Green	O2	Black
PCWS/R	Green	CWS/CWR	Black
Steam	Black	STM	White
Cylinder Gas	Light Blue	SG	Black

- I. Electrical Pedestal Boxes:
 1. Electrical pedestal boxes shall be cast aluminum with an integral base. Pedestal shall be machined for both standard and ground fault receptacles, and shall be furnished complete with grounding screw(s), mounting shank, locknut, and washer. Electrical boxes shall be listed by Underwriters Laboratory (UL) under Standard UL514A. Receptacles shall be heavy-duty, industrial specification grade; type as indicated on Drawings. Face plates shall be Type 302 stainless steel with formed beveled edges.
 2. Finish:
 - A. Polished aluminum with clear epoxy coating.
 3. Devices shall be connected to the electrical system under the scope of work of Division 26.

2.3 LABORATORY SAFETY EQUIPMENT

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory safety fixtures specified in this section shall be provided by a single manufacturer.
 1. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: 312 666-5500. website: <http://www.wsflab.com/>.
 2. Haws Drinking Faucet Co., 1435 Fourth Street, PO Box 1999, Berkeley, CA 94701 Tel: 510 525-5801. website: <http://www.hawsc.com/>.
 3. Guardian Equipment, 660 N. Union St., Chicago, IL 60610 Tel: 312 733-2626. website: <http://www.gesafety.com/>.

Substitutions are permitted subject to Section 01 63 00.
- B. General: Laboratory safety equipment shall be certified in accordance with ANSI Z358.1-2004.
- C. EWES-1: Barrier-free safety station with swing-down eye/face wash and emergency shower actuation valve in stainless steel cabinet for recess mounting: Water Saver Model No. SSBF2120, or approved equal, with the following characteristics or modifications.
 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 with flip-top dust covers.
 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 (1.3mm) 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.
- D. EWES-2: Barrier free safety station/freestanding: Stay-open shower valve and eye/face wash with stainless steel bowl and stay-open ball valve. All polished chrome plated brass construction. Water Saver Model No. SSBF909PCC, or approved equal, with the following characteristics or modifications.
 1. Pull rod shall be polished stainless steel.
 2. Exposed piping and showerhead shall polished chrome plated brass.
 3. Cast aluminum floor flange.
 4. Eyewash heads shall be ABS plastic with flip-top dust covers.
 5. Eyewash flag handle shall be powder-coated cast aluminum or stainless steel.
 6. Stainless steel bowl shall have No. 4 finish.
 7. Stay-open chrome plated brass ball valves.
 8. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.

- E. ES-1: Barrier-free emergency shower with activation valve in stainless steel cabinet for recessed mounting: Water Saver Model No. ESBF672, or approved equal, with the following characteristics or modifications.
 - 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. Safety shower actuating arm shall be mounted in a flanged, recessed-mounted 18 gauge (1.3mm) stainless steel cabinet with No. 4 finish.
 - 6. Stay-open brass ball valve concealed behind stainless steel/access panel housing.
 - 7. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.
- F. EW-1: Eye/face wash with two fine spray heads, 90 degree swivel feature and deck mounting: Water Saver Model No. FE774, or approved equal, with the following characteristics or modifications.
 - 1. Exposed piping shall be all-polished chrome.
 - 2. Eyewash heads shall be ABS plastic.
 - 3. Stay-open chrome-plated brass ball valve.

2.4 FINISHES

- A. 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.
 - 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. Finish:
 - A. Polished.
 - 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.
- B. Colored coating:
 - 1. Applicable to:
 - A. 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. Surfaces shall have a minimum finished coating thickness of 2 mils.
 - 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. ft. capacity, approximately 12 IN above open beakers, each containing 100 ml of 70 percent nitric acid, 94 percent sulfuric acid and 35 percent 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 degrees 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	
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	

Reagent	Concentration
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 IN-pounds. 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. Provide sinks at locations indicated on the Laboratory Furnishings drawings. Refer to Laboratory Sink Schedule for types.
- B. Epoxy Resin:
 1. Manufacturer: Manufacturer shall be the manufacturer of the epoxy resin work surfaces specified in Section 12 35 53.
 2. Laboratory Sinks:
 - A. Under-mount Type: Under-mount installation by Division 11 in epoxy resin work surfaces. Color to match work surface.
 - B. Comply with the requirements of Section 12 35 53 for epoxy resin.
 - C. All exposed edges shall be radiused not less than 1/4 IN.
 - D. Tops without drain grooves: Sink shall be set 1/8 IN below the level of the adjacent surface.
 - E. Provide epoxy resin sink outlet with strainer, stopper and open-end overflow, and install in sink with continuous bead of silicone sealant.
 - F. 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, and at wall locations (see drawings).
 - 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 12 35 53 for epoxy resin.
 - D. Provide strainer for all cup sinks.
 - E. Provide mounting bracket for wall-mounted cup sinks.
- C. Stainless steel:
 1. Laboratory Sinks, integral with stainless steel work surface:
 - A. Refer to Section 12 35 53, 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.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

- A. Inspection:
 - 1. Prior to installation of fixtures 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.
- C. Installation:
 - 1. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.
 - 2. Install fixtures plumb and level.
 - 3. Provide piping connections to fixtures with valves and escutcheons as specified in Division 22.
 - 4. Verify that fixtures and trim are tight, leak-free and function properly

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.
- B. Set sinks in chemical resistant sealing compound, secure and support, as recommended by the manufacturer.
- C. Emergency Showers:
 - 1. Emergency showers must be installed with a minimum of 16 IN of clearance from any obstruction to the center of the showerhead (eyewash or eye/face wash fixture is not considered an obstruction).
 - 2. In all cases, emergency showers shall be installed with showerhead positioned not lower than 82 IN or above 96 IN measured from the operational standing surface. Refer to drawings for mounting height within that range. If no range is provided, shower head shall be installed 96 IN above the operational standing surface.

END OF SECTION

SECTION 12 05 01

FURNITURE AND FURNISHINGS - GENERAL REQUIREMENTS (Revised AD-4)

PART 1 - GENERAL

1.1 DEFINITIONS

- A. C.O.M.: Customer's own material.

1.2 QUALITY ASSURANCE

- A. Review General Conditions of the Contract.
- B. Furniture and furnishings may be inspected by Laboratory, and Architect at manufacturer's plant prior to shipment; and will be inspected by Laboratory and/or Architect after delivery by Contractor on Project premises.
- C. Furniture and furnishings found to be not in accordance with specifications and approved submittals may be rejected.
- D. Contractor replace rejected furniture and furnishings at no cost to Laboratory.
- E. Although not indicated, Work includes providing supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete and functional installation.
- F. Contractor is solely responsible for coordination of scope of Work for its own forces, and of Subcontractors and suppliers, and to complete all Work, whether performed by the Contractor or a Subcontractor.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawing of custom furniture.
- B. Samples:
 - 1. Sample of fabric and finishes selected.
 - a. Clearly mark each sample with the following information:
 - 1) Furniture item code.
 - 2) Manufacturer.
 - 3) Finish and/or fabric code type.
- C. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- D. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.

-
2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 3. MR 7.0, Certified Wood: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body; include statement indicating costs for each certified wood product.
 4. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturer's product data indicating VOC content of adhesive.
 5. EQ 4.2, Low-Emitting Materials – Paints and Coatings: Manufacturer's product data indicating VOC content of curing agents applied inside building envelope.
 6. EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Manufacturer's product data for each composite wood product used indicating that no urea formaldehyde is used in the production of the product.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Description:
 1. Furnish labor, materials, tools, equipment, work and services for delivery, unloading, unpacking, assembly, staging and other handling of furniture and furnishings.
 2. Laboratory provide final placement and installation of furniture and furnishings.
- B. Job conditions:
 1. Comply with applicable codes.
 2. Accomplish work to avoid damages to Project premises and to furniture and furnishings.
 3. Clean up debris, haul it off Project site.
 4. Provide fire protection.
- C. Product delivery:
 1. By manufacturer's normal means.
 2. In manufacturer's original labeled containers, or blanket wrapped.
 3. Contractor responsible for acceptance at Site.
 4. Schedule deliveries to avoid delaying work.
 5. Coordinate deliveries with the Laboratory's schedule.
- D. Product handling, staging and installation - general:
 1. For unloading, receiving and other handling of furniture and furnishings, use methods to avoid damage to items and structure.
 2. Protect furniture and furnishings items from weather damage.
 3. Handle items to avoid contamination from other sources.
 4. Place only in authorized areas as determined by Laboratory on Project site.
 5. Unpack items.
 6. Remove and dispose of debris.
 7. Inspect items for damage and correctness as soon as possible after delivery. Reorder so as to avoid delays.
 8. Replace, or repair to new condition, each damaged item.
 9. Use of repaired items in Project is subject to approval by Laboratory and Architect.
 10. After unpacking furniture and furnishings, protect from dust accumulation by covering items with non-staining dust covers until final placement.
- E. Clean-up:
 1. Dispose of excess material and debris off Site.

AD-1:

- F. Environmental considerations:

-
1. Packaging: Deliver materials in recyclable or in reusable packaging such as cardboard, wood, paper, or reusable blankets, which shall be reclaimed by supplier or manufacturer for recycling.
 2. Minimize packaging materials to maximum extent possible while still ensuring protection of materials during delivery, storage, and handling.
 - a. Unacceptable Packaging Materials: Polyurethane, polyisocyanurate, polystyrene, polyethylene, and similar plastic materials such as foam plastics and shrink-fit plastics.
 - b. Reusable Blankets: Deliver and store materials in reusable blankets and mats reclaimed by manufacturers or suppliers for reuse where program exists or where program can be developed for such reuse.
 - c. Pallets: Where pallets are used, suppliers shall be responsible to ensure pallets are removed from site for reuse or for recycling.
 - d. Corrugated Cardboard and Paper: Where paper products are used, recycle as part of construction waste management recycling program, or return to material's manufacturer for use by manufacturer or supplier.
 - e. Sealants, Paint, Primers, Adhesives, and Coating Containers: Return to supplier or manufacturer for reuse where such program is available.

PART 2 - PRODUCTS

2.1 FURNITURE AND FURNISHINGS

- A. Provide furniture and furnishings of each specialty type (as designated by Furniture Specification) by one manufacturer, except as may otherwise be indicated within specification.
- B. Furniture specifications:
 1. See specification by item for individual specified items. Any discrepancies or questions shall be brought to the attention of the Architect.
 2. Systems furniture and seating shall comply with Greenguard Indoor Air Quality certified furniture, ANSI/BIFMA standards M7.1-2007 and X7.1-2007 or EPA ETV Large Test Chamber Protocol.
- C. Locking:
 1. Furniture, whether or not indicated, shall be lockable.
 2. Items located within the same room shall be keyed alike.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine Project site relative to adequacy of facilities available for delivery, unloading, unpacking, staging and other handling of items.
- B. Report unsatisfactory conditions to Architect.
- C. Do not start work until unsatisfactory conditions have been corrected.
- D. Start of work constitutes acceptance of responsibility for performance.

3.2 ORDERING

- A. Order materials required promptly after receipt of signed contract or letter of intent, and provide the Architect with dated copies of purchase orders at the same time that the order has been placed. Provide the Architect with dated copies of manufacturers acknowledgements of orders upon receipt.

-
- B. It will be the responsibility of the Contractor to supply fabric samples of C.O.M.'s and verify quantities of C.O.M.'s.

3.3 INSTALLATION

- A. It shall be the responsibility of the Contractor to coordinate the receiving, handling, storage, delivery and installation of the equipment with the Laboratory's schedule. Be responsible for theft or damage to material until delivered to the building, installed in its designated location, and accepted by the Laboratory and Architect. Inquiries regarding delivery and installation requirement dates shall be direct to the Laboratory.
- B. Follow manufacturer's printed instructions and drawings for additional assembly required on site for furniture and furnishings
- C. The work shall be performed with skilled installers. If the Contractor proposes to use a subcontractor to provide the installation service, the proposed subcontractor and qualifications shall be submitted with the Contractor's bid. If the proposed subcontractor is approved by the Laboratory and Architect, the Contractor shall, upon request, submit written evidence that a contract exists between the Contractor and Installer.
- D. All furniture, furnishings and equipment shall be delivered to the building, uncrated, placed in its proper location, assembled, leveled, cleaned, made ready for use, and complete in every respect.
- E. Test and adjust furniture and furnishing items for satisfactory operation.
- F. The location requirements and furniture code items are indicated on Furniture Floor Plans (I-Sheets). Each individual item shall have a manufacturer's tag with model numbers, Architect's furniture code, and the room number in which the item is to be placed. Architect shall supply successful contractor with computerized listing of items and locations.
- G. It shall be the responsibility of the contractor to verify local conditions, corridor elevators and stair, etc., and to allow installation of large furniture furnishing items. Items determined to be too large to negotiate and fit shall be manufactured in sections and assembled at the site. Areas should be field verified before ordering to make sure that furniture will fit without any problems.
- H. Take precaution to protect the building from damage during installation. Any damage deemed the responsibility of the Contractor shall be repaired by the Laboratory with the cost deducted from payment to the Contractor.
- I. Before installing tackboards, whiteboards, clocks, or any items attached to walls, verify with the Laboratory the exact locations.
- J. It shall be the responsibility of the Contractor to verify quantities on the drawings and report any discrepancies to the Architect.

3.4 CLEANUP

- A. Periodically and upon completion of the installation, remove waste, dirt, wrappings, and excess materials, tools and equipment, and shall carefully and thoroughly clean surfaces to the satisfaction of the Architect and Laboratory. Furniture and furnishings shall be left in show room condition and ready for use.

GENERAL NOTES

1. All items must be priced using the federal supply schedule.
2. Each furniture dealer is responsible to coordinate all COM approvals, yardage approvals and reservations.
They are also responsible to provide COM submittals to HDR (the designer) for approval, before their order is submitted.
3. The systems furniture dealer is responsible to field-verify all critical dimensions of areas where furniture is to be installed.
4. Images are for reference only and are not to scale. Written specifications take precedence.
5. Finishes are for reference only.
6. All fabrics must be treated for stain resistance, if not inherent.
7. Only furniture items keyed on attached plan are to be included in this package.
8. Provide leveling glides on all furniture pieces, if not already standard from manufacturer.
9. Grommet locations shall be determined by ANL in the field.
10. Final configuration of O-18 to be determined by ANL once final manufacturer is selected.
11. Provide carpet casters throughout unless noted otherwise.
12. Installation shall not be complete until all lamps and electrical outlets operate correctly. See electrical schedule for information regarding task lighting.
13. The systems furniture dealer shall work with the Contractor's electrician to coordinate connecting their power cords and if applicable their power poles.
14. Refer to drawings to coordinate work station circuitry.
15. Contact HDR Architecture Inc., Krysis Lynch, at 773.380.7954, if there are any questions relating to specifications.
16. ANL does not require any added stock.

FURNITURE KEY: A - 1
Location: OFFICES, WORKSTATIONS AND CUBICLES Qty - 236 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	STEELCASE	
Name:	SOTO LED	
Model #:	DSLEDF	
Overall Dimensions:	4.25W x 13.25D x 14.75H	
Features:	- FREESTANDING BASE - 4 WATT LED	
FINISH:		
Frame:	PLATINUM	
GSA CONTRACT INFO		
Contract #:	GS-27F-0014V	
Contract Duration:	THRU MARCH 12, 2014	
MANUFACTURER'S REPRESENTATIVE:		
Name:	STACEY-HARLOE-MOWERY	
Email:	SHARLOE1@STEELCASE.COM	
Buisness:	(312) 321-3771	
Cell:	(312) 590-3328	
		PLATINUM

ADDITIONAL NOTES:
EACH OFFICE, WORKSTATION AND CUBICLE TO RECEIVE AN INDIVIDUAL TASK LIGHT

- ALTERNATE MANUFACTURERS:**
1. HUMANSCALE - ELEMENT 790
 2. HERMAN MILLER - FLUTE LED

FURNITURE KEY: A - 2
Location: STAIR BENCH Qty - 3 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	TO BE SELECTED
Name:	UPHOLSTERED BENCH CUSHION
Model #:	N/A
Overall Dimensions:	54W x 118D x 1H, FINAL DIMENSION - V.I.F.
Features:	- CUSHION WITH COMMERCIAL GRADE FOAM - FOAM TO BE FLAME RETARDANT, MEETING CAL 177 CODE. - SEAMING: TRIPLE STITCH
FINISH:	
Upholstery:	SPINNEYBECK - VO 902
GSA CONTRACT INFO	
Contract #:	N/A
Contract Duration:	N/A
MANUFACTURER'S REPRESENTATIVE:	
Name:	TBD
Email:	--
Buisness:	--
Cell:	--



VO 902

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

FURNITURE KEY: A - 3
Location: DOLLY FOR S-11 Qty - 6 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	KNOLL
Name:	MULTIGENERATION CHAIR DOLLY
Model #:	2SDOLLY
Overall Dimensions:	19.7W x 43.8D x 27.1H
Features:	- STACKS 10 HIGH



FINISH:

Upholstery:	
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GSA CONTRACT INFO

Contract #:	GS-28F-8029H
Contract Duration:	THRU DECEMBER 12, 2012

MANUFACTURER'S REPRESENTATIVE:

Name:	DIANE MCCULLOUGH
Email:	DMCCULLO@KNOLL.COM
Buisiness:	(312) 454-7319

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

DOLLY TO MATCH CHAIRS LISTED AS ALTERNATE MANUFACTURERS UNDER S-11

FURNITURE KEY: F-1
Location: DALD/ALD OFFICES Qty - 4 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N/A
Overall Dimensions:	30W x 18D x 2 DRAWER HEIGHT
Features:	- WOOD VENEER FRONT, TOP AND EDGE - PROVIDE COUNTERWEIGHT - WITH LOCK
FINISH:	
Top:	LIGHT ANIGRE EY
Edge:	LIGHT ANIGRE EY
Base:	METALLIC BRONZE EH
GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012
MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisiness:	(312) 339-8578
Cell:	(312) 822-8473



WOOD TOP/EDGE FNISH: LIGHT ANIGRE EY

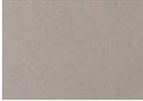


BASE FINISH: METALLIC BRONZE EH

ADDITIONAL NOTES:
- WOOD VENEER COUNTERTOP TO BE ADDED TO GROUPS OF TWO LATERAL FILES. SEE PLANS FOR LOCATION.

- ALTERNATE MANUFACTURERS:**
1. STEELCASE - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 2. ALLSTEEL - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 3. HAWORTH - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: F-2
Location: OPEN OFFICE/DALD OFFICE Qty - 6 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	MERIDIAN STORAGE	
Model #:	N/A	
Overall Dimensions:	30W x 18D x 4 DRAWER HEIGHT	
Features:	- PROVIDE COUNTERWEIGHT - WITH LOCK	
FINISH:		
Top:	METALLIC BRONZE EH	
Edge:	METALLIC BRONZE EH	
Base:	METALLIC BRONZE EH	
GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	
Contract Duration:	THRU DECEMBER 31, 2012	
MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	 FINISH: METALLIC BRONZE EH
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisiness:	(312) 339-8578	
Cell:	(312) 822-8473	

ADDITIONAL NOTES:

- ALTERNATE MANUFACTURERS:**
1. STEELCASE - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 2. ALLSTEEL - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 3. HAWORTH - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: F-3
Location: OPEN OFFICE Qty - 9 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	HERMAN MILLER
Name:	MERIDIAN STORAGE
Model #:	N/A
Overall Dimensions:	42W x 20D x 4 DRAWER HEIGHT
Features:	- PROVIDE COUNTERWEIGHT - WITH LOCK
FINISH:	
Top:	METALLIC BRONZE EH
Edge:	METALLIC BRONZE EH
Base:	METALLIC BRONZE EH
GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012
MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness:	(312) 339-8578
Cell:	(312) 822-8473

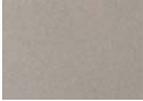


FINISH: METALLIC BRONZE EH

ADDITIONAL NOTES:

- ALTERNATE MANUFACTURERS:**
1. STEELCASE - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 2. ALLSTEEL - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 3. HAWORTH - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: F-4
Location: OPEN OFFICE Qty - 4 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	MERIDIAN STORAGE	
Model #:	N/A	
Overall Dimensions:	36W x 20D x 4 DRAWER HEIGHT	
Features:	- PROVIDE COUNTERWEIGHT - WITH LOCK	
FINISH:		
Top:	METALLIC BRONZE EH	
Edge:	METALLIC BRONZE EH	
Base:	METALLIC BRONZE EH	
GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	
Contract Duration:	THRU DECEMBER 31, 2012	
MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	 FINISH: METALLIC BRONZE EH
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness:	(312) 339-8578	
Cell:	(312) 822-8473	

ADDITIONAL NOTES:

- ALTERNATE MANUFACTURERS:**
1. STEELCASE - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 2. ALLSTEEL - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 3. HAWORTH - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: F-5
Location: OPEN OFFICE Qty - 3 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	HERMAN MILLER
Name:	MERIDIAN STORAGE
Model #:	N/A
Overall Dimensions:	30W x 20D x 4 DRAWER HEIGHT
Features:	- PROVIDE COUNTERWEIGHT - WITH LOCK
FINISH:	
Top:	METALLIC BRONZE EH
Edge:	METALLIC BRONZE EH
Base:	METALLIC BRONZE EH
GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012
MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness:	(312) 339-8578
Cell:	(312) 822-8473
ADDITIONAL NOTES:	



FINISH: METALLIC BRONZE EH

ALTERNATE MANUFACTURERS:

1. STEELCASE - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
2. ALLSTEEL - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
3. HAWORTH - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: F-6	
Location: OPEN OFFICE	Qty - 9 TOTAL

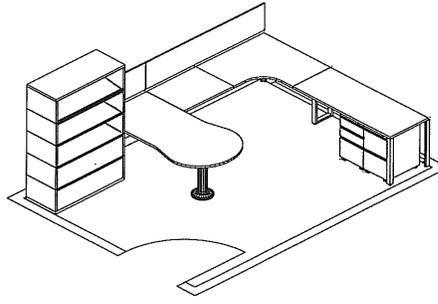
PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	MERIDIAN STORAGE	
Model #:	N/A	
Overall Dimensions:	30W x 20D x 2 DRAWER HEIGHT	
Features:	- PROVIDE COUNTERWEIGHT - WITH LOCK - PROVIDE COUNTERTOP SURFACE ACROSS MULTIPLES	
FINISH:		
Top:	METALLIC BRONZE EH	<p>FINISH: METALLIC BRONZE EH</p>
Edge:	METALLIC BRONZE EH	
Base:	METALLIC BRONZE EH	
GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	
Contract Duration:	THRU DECEMBER 31, 2012	
MANUFACTURER'S REPRESENTATIVE:		 <p>FINISH: METALLIC BRONZE EH</p>
Name:	CINDY FARIAS	
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness:	(312) 339-8578	
Cell:	(312) 822-8473	
ADDITIONAL NOTES:		

ALTERNATE MANUFACTURERS:
1. STEELCASE - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
2. ALLSTEEL - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
3. HAWORTH - LATERAL FILE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: O - 1
Location: PRIVATE OFFICE Qty - 100 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	VARIES, SEE FEATURES
Features:	<p>ONE PERSON PRIVATE OFFICE:</p> <ul style="list-style-type: none"> - (1) 30W x 24D SQUARED-EDGE BRIDGE SURFACE WITH GROMMET - (1) 42W x 24D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 60 x 24D SQUARE-EDGE RECTANGULAR RETURN - (1) 66W X 30D SQUARE-EDGE PENINSULA SURFACE, ROUNDED WITH SUPPORT POST LEG - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 102W x 24H TACKBOARD - ALL LEGS: SQUARE OPEN SUPPORT LEGS (EXCEPT POST LEG)



FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

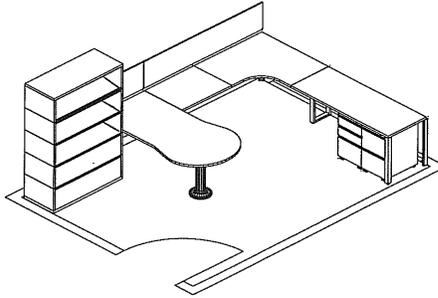
ADDITIONAL NOTES:
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

- ALTERNATE MANUFACTURERS:**
1. STEELCASE
 2. ALLSTEEL
 3. HAWORTH

FURNITURE KEY: O - 2
Location: OFFICE - SIMILAR TO O-1 Qty - 4 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	VARIES, SEE FEATURES
Features:	<p>ONE PERSON PRIVATE OFFICE:</p> <ul style="list-style-type: none"> - (1) 30W x 24D SQUARED-EDGE BRIDGE SURFACE WITH GROMMET - (1) 42W x 24D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 30W x 24D SQUARE-EDGE RECTANGULAR RETURN - (1) 66W X 30D SQUARE-EDGE PENINSULA SURFACE, ROUNDED WITH SUPPORT POST LEG - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 102W x 24H TACKBOARD - ALL LEGS: SQUARE OPEN SUPPORT LEGS (EXCEPT POST LEG)
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04



GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



CANYON ZEPHYR D1

MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473



METALLIC BRONZE EH



CROSSING - PORCELAIN 8T04

ADDITIONAL NOTES:
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

- ALTERNATE MANUFACTURERS:**
1. STEELCASE
 2. ALLSTEEL
 3. HAWORTH

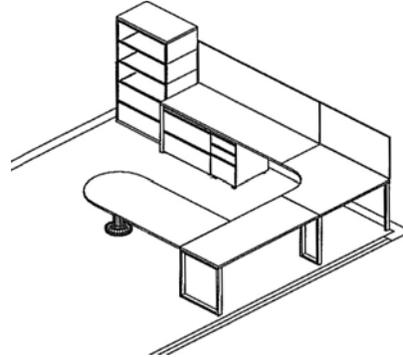
FURNITURE KEY: O - 3

Location: DALD AND ALD OFFICE - 3RD FLOOR

Qty - 2 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	VARIES, SEE FEATURES
Features:	<p>ONE PERSON PRIVATE OFFICE:</p> <ul style="list-style-type: none"> - (1) 60W x 24D SQUARE-EDGE RECTANGULAR RETURN WITH GROMMET - (1) 42W x 24D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 72W x 24D SQUARE-EDGE BRIDGE SURFACE - (1) 66W X 30D SQUARE-EDGE PENINSULA SURFACE, ROUNDED WITH SUPPORT POST LEG - (1) 30Wx24D 2 HIGH UNDER COUNTER LATERAL FILE - WOOD VENEER - (1) B/B/F MOBILE PEDESTAL - WOOD VENEER - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - WOOD VENEER - (1) 114W x 24H TACKBOARD - ALL LEGS: SQUARE OPEN SUPPORT LEGS (EXCEPT POST LEG)



FINISH:

Worksurface:	LIGHT ANIGRE EY
Edge:	LIGHT ANIGRE EY
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



WOOD TOP/EDGE FINISH:
LIGHT ANIGRE EY

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473



METALLIC BRONZE EH



CROSSING - PORCELAIN 8T04

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

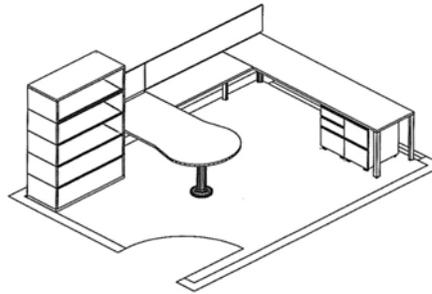
ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 4
Location: OFFICE - 2ND FLOOR Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	VARIES, SEE FEATURES
Features:	<p>ONE PERSON PRIVATE OFFICE:</p> <ul style="list-style-type: none"> - (1) 60W x 24D SQUARED-EDGE BRIDGE SURFACE WITH GROMMET - (1) 48W x 18D SQUARE-EDGE RECTANGULAR RETURN - (1) 66W X 30D SQUARE-EDGE PENINSULA SURFACE, ROUNDED WITH SUPPORT POST LEG - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 90W x 24H TACKBOARD - ALL LEGS: SQUARE OPEN SUPPORT LEGS (EXCEPT POST LEG)
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04



O-4 LAYOUT SIMILAR TO ABOVE, SEE IF-102A

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

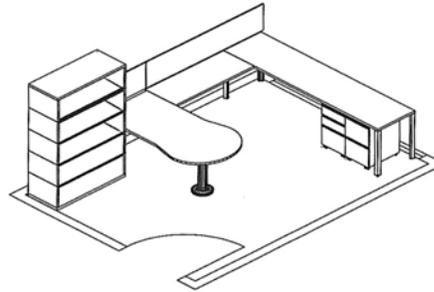
ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 5
Location: OFFICE Qty - 4 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	VARIES, SEE FEATURES
Features:	<p>ONE PERSON PRIVATE OFFICE:</p> <ul style="list-style-type: none"> - (1) 60W x 24D SQUARED-EDGE BRIDGE SURFACE WITH GROMMET - (1) 72W x 18D SQUARE-EDGE RECTANGULAR RETURN - (1) 66W X 30D SQUARE-EDGE PENINSULA SURFACE, ROUNDED WITH SUPPORT POST LEG - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 90W x 24H TACKBOARD - ALL LEGS: SQUARE OPEN SUPPORT LEGS (EXCEPT POST LEG)
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04



O-5 LAYOUT SIMILAR TO ABOVE, SEE IF-001

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

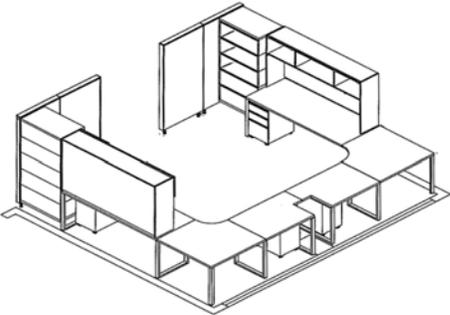
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 6	
Location: WORKSTATION	Qty - 2 TOTAL

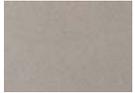
PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER	 <p>IMAGE ABOVE SHOWS TWO WORKSTATIONS</p>
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	APPROX 7"W x 12'-6"D x 5'8"H	
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 66W x 30D RETURN WITH GROMMET - (1) 42W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 108W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W x 18D x 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 108W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS 	
FINISH:		
Worksurface:	CANYON ZEPHYR D1	
Edge:	CANYON ZEPHYR D1	
Metal Finish:	METALLIC BRONZE EH	
Upholstery:	CROSSING - PORCELAIN 8T04	

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H	 <p>CANYON ZEPHYR D1</p>
Contract Duration:	THRU DECEMBER 31, 2012	

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS	 <p>METALLIC BRONZE EH</p>
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	 <p>CROSSING - PORCELAIN 8T04</p>

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 7
Location: WORKSTATION Qty - 8 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 7"W x 12'-6"D x 5'8"H
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 74W x 30D RETURN WITH GROMMET - (1) 40W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 74W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 74W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS

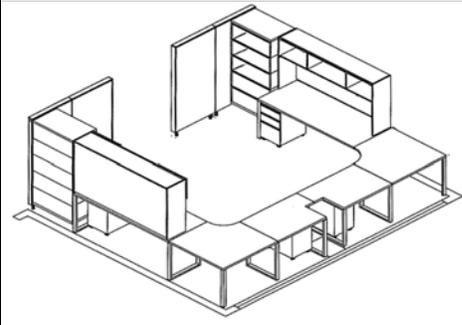


IMAGE ABOVE SHOWS TWO WORKSTATIONS

FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 8
Location: WORKSTATION - SIMILAR TO O-7 Qty - 8 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 7"W x 12'-6"D x 5'8"H
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 74W x 30D RETURN WITH GROMMET - (1) 40W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 74W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 74W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

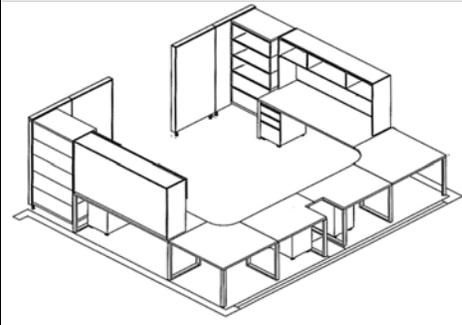


IMAGE ABOVE SHOWS TWO WORKSTATIONS

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

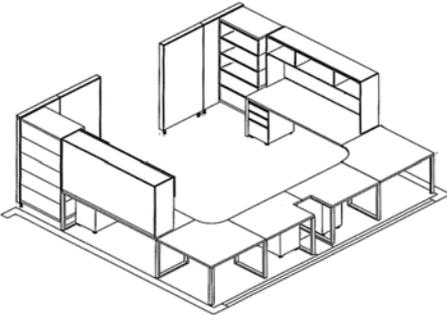
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 9
Location: WORKSTATION Qty - 8 TOTAL

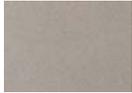
PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER	 <p>IMAGE ABOVE SHOWS TWO WORKSTATIONS</p>
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	APPROX 7"W x 9'-6"D x 5'8"H	
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 36W x 30D RETURN WITH GROMMET - (1) 36W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 80W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 80W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS 	
FINISH:		
Worksurface:	CANYON ZEPHYR D1	
Edge:	CANYON ZEPHYR D1	
Metal Finish:	METALLIC BRONZE EH	
Upholstery:	CROSSING - PORCELAIN 8T04	

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H	 <p>CANYON ZEPHYR D1</p>
Contract Duration:	THRU DECEMBER 31, 2012	

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS	 <p>METALLIC BRONZE EH</p>
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	 <p>CROSSING - PORCELAIN 8T04</p>

ADDITIONAL NOTES:

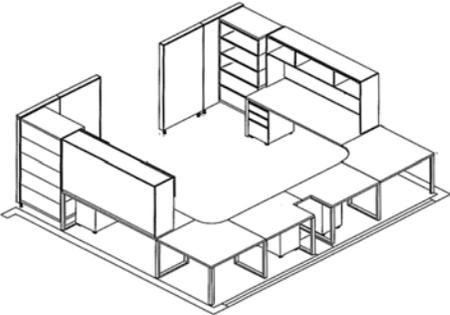
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 10
Location: WORKSTATION - SIMILAR TO O-9 Qty - 4 TOTAL

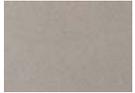
PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER	 <p>IMAGE ABOVE SHOWS TWO WORKSTATIONS</p>
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	APPROX 7"W x 9'-6"D x 5'8"H	
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 36W x 30D RETURN WITH GROMMET - (1) 41W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 80W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 80W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS 	
FINISH:		
Worksurface:	CANYON ZEPHYR D1	
Edge:	CANYON ZEPHYR D1	
Metal Finish:	METALLIC BRONZE EH	
Upholstery:	CROSSING - PORCELAIN 8T04	

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H	 <p>CANYON ZEPHYR D1</p>
Contract Duration:	THRU DECEMBER 31, 2012	

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS	 <p>METALLIC BRONZE EH</p>
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	 <p>CROSSING - PORCELAIN 8T04</p>

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 11
Location: WORKSTATION Qty - 8 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 7"W x 10'D x 5'8"H
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 42W x 30D RETURN WITH GROMMET - (1) 40W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 42W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 42W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS

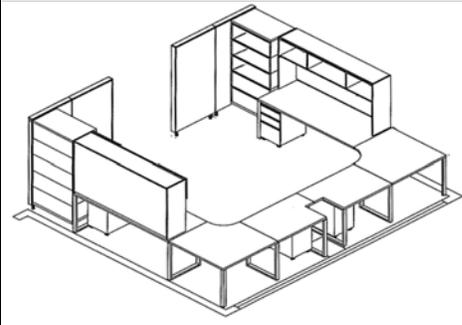


IMAGE ABOVE SHOWS TWO WORKSTATIONS

FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

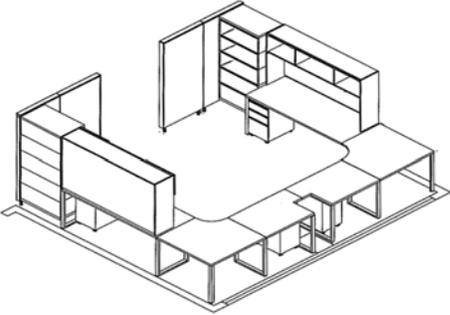
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 12
Location: WORKSTATION - SIMILAR TO O-11 Qty - 3 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER	 <p>IMAGE ABOVE SHOWS TWO WORKSTATIONS</p>
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	APPROX 6'-8"W x 10'D x 5'8"H	
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 42W x 30D RETURN WITH GROMMET - (1) 36W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 42W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 42W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS 	
FINISH:		
Worksurface:	CANYON ZEPHYR D1	
Edge:	CANYON ZEPHYR D1	
Metal Finish:	METALLIC BRONZE EH	
Upholstery:	CROSSING - PORCELAIN 8T04	

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H	 <p>CANYON ZEPHYR D1</p>
Contract Duration:	THRU DECEMBER 31, 2012	

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS	 <p>METALLIC BRONZE EH</p>
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	 <p>CROSSING - PORCELAIN 8T04</p>

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 13
Location: WORKSTATION - SIMILAR TO O-12 Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 6'-8"W x 10'D x 5'8"H
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 42W x 30D RETURN WITH GROMMET - (1) 36W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 42W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 42W TACKBOARD ABOVE RETURN, CUSTOM HEIGHT TO UNDERSIDE OF OPEN SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

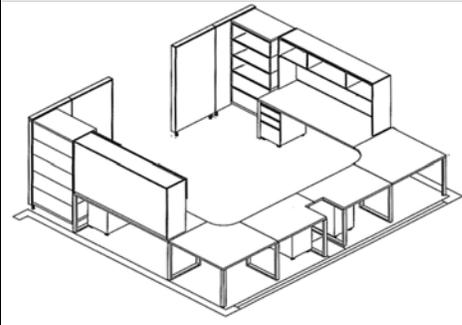


IMAGE ABOVE SHOWS TWO WORKSTATIONS

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

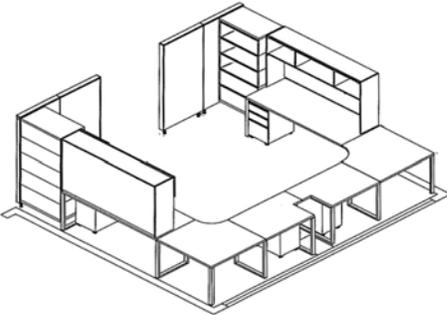
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 14
Location: WORKSTATION Qty - 38 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER	 <p>IMAGE ABOVE SHOWS TWO WORKSTATIONS</p>
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	APPROX 7'W x 12'-6"D x 5'8"H	
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 72W x 30D RETURN WITH GROMMET - (1) 39W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 72W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4'0" W CLEAR ENTRY) - (4) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4'0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS 	

FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012

MANUFACTURER'S REPRESENTATIVE:		 <p>CANYON ZEPHYR D1</p>
Name:	CINDY FARIAS	 <p>METALLIC BRONZE EH</p>
Email:	CINDY_FARIAS@HERMANMILLER.COM	 <p>CROSSING - PORCELAIN 8T04</p>
Business 1:	(312) 339-8578	
Business 2:	(312) 822-8473	

ADDITIONAL NOTES:
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

- ALTERNATE MANUFACTURERS:**
1. STEELCASE
 2. ALLSTEEL
 3. HAWORTH

FURNITURE KEY: O - 15
Location: WORKSTATION - SIMILAR TO O-14 Qty - 6 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 7"W x 12'-6"D x 5'8"H
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 72W x 30D RETURN WITH GROMMET - (1) 39W x 30D RETURN (WITH CUSTOM CUT AROUND COLUMNS) - (1) 72W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W x 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - (4) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY) - ALL LEGS: SQUARE OPEN SUPPORT LEGS

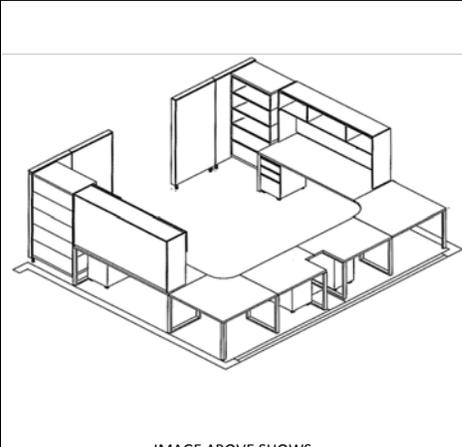


IMAGE ABOVE SHOWS TWO WORKSTATIONS

FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

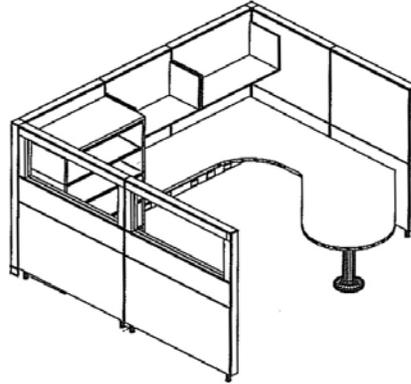
FURNITURE KEY: O - 16

Location: CUBICLE - 2ND, 3RD FLOOR

Qty - 20 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 8' x 9' x 5'8"
Features:	<p>ONE PERSON CUBICLE UNIT:</p> <ul style="list-style-type: none"> - (1) 36W x 24D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 26W x 24D RETURN - (2) OPEN SHELVES ABOVE RETURN/WK SURFACE - (1) 60W X 36D: SQUARED-EDGE PENINSULA SURFACE, ROUND END WITH SUPPORT POST LEG - WITH GROMMET LOCATED AT BACK - CENTER - (1) B/B/F MOBILE PEDESTAL - (1) 36W X 24D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - 68 H TACKABLE UPHOLSTERED PANELS, TOP TIER GLASS, AT THREE SIDES, SEE PLAN ON IF-001



FINISH:

Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Business 1:	(312) 339-8578
Business 2:	(312) 822-8473



CANYON ZEPHYR D1



METALLIC BRONZE EH



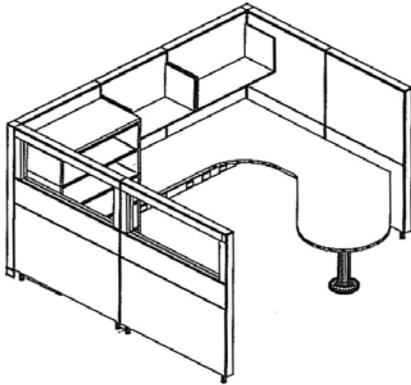
CROSSING - PORCELAIN 8T04

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 17
 Location: CUBICLE - 2ND, 3RD FLOOR - WITHOUT BACK PANEL Qty - 4 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	APPROX 8' x 9' x 5'8"	
Features:	ONE PERSON CUBICLE UNIT: - (1) 36W x 24D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 26W x 24D RETURN - (2) OPEN SHELVES ABOVE RETURN/WK SURFACE - (1) 60W X 36D: SQUARED-EDGE PENINSULA SURFACE, ROUND END WITH SUPPORT POST LEG - WITH GROMMET LOCATED AT BACK - CENTER - (1) B/B/F MOBILE PEDESTAL - (1) 36W X 24D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - 68 H TACKABLE UPHOLSTERED PANELS, TOP TIER GLASS, AT TWO SIDES ONLY, SEE PLAN ON IF-001	
FINISH:		
Worksurface:	CANYON ZEPHYR D1	
Edge:	CANYON ZEPHYR D1	
Metal Finish:	METALLIC BRONZE EH	
Upholstery:	CROSSING - PORCELAIN 8T04	
GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	
Contract Duration:	THRU DECEMBER 31, 2012	
MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	
		 CANYON ZEPHYR D1  METALLIC BRONZE EH  CROSSING - PORCELAIN 8T04

ADDITIONAL NOTES:

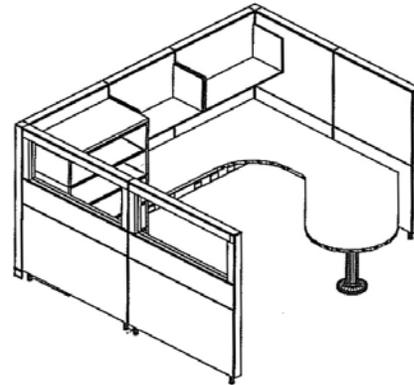
ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 18
Location: CUBICLE - 2ND, 3RD FLOOR - WITHOUT FRONT PANEL Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 8' x 9' x 5'8"
Features:	<p>ONE PERSON CUBICLE UNIT:</p> <ul style="list-style-type: none"> - (1) 36W x 24D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 26W x 24D RETURN - (2) OPEN SHELVES ABOVE RETURN/WK SURFACE - (1) 60W X 36D: SQUARED-EDGE PENINSULA SURFACE, ROUND END WITH SUPPORT POST LEG - WITH GROMMET LOCATED AT BACK - CENTER - (1) B/B/F MOBILE PEDESTAL - (1) 36W X 24D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - 68 H TACKABLE UPHOLSTERED PANELS, TOP TIER GLASS, AT TWO SIDES ONLY, SEE PLAN ON IF-001
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04



GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

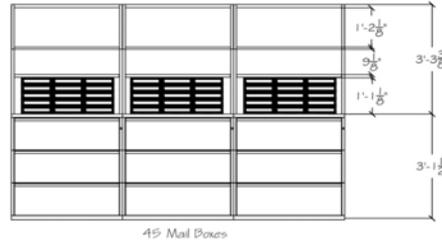
ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 19
Location: C / P / F - ALL FLOORS Qty - 7 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	108W x 24D x 76.875H
Features:	FREESTANDING MILLWORK UNIT: - (9) 24"D OPEN SHELVES BELOW COUNTER - (9) 12"D OPEN SHELVES ABOVE COUNTER - 45 THRIVE PAPER TRAY MAIL BOXES AS SHOWN
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH



GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473
Buisness 2:	(312) 822-8473



ADDITIONAL NOTES:

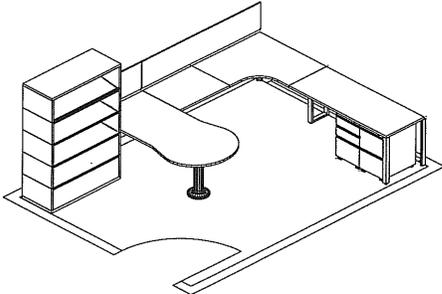
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: O - 20
Location: PRIVATE OFFICE Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER	
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	VARIES, SEE FEATURES	
Features:	<p>ONE PERSON PRIVATE OFFICE:</p> <ul style="list-style-type: none"> - (1) 30W x 24D SQUARED-EDGE BRIDGE SURFACE WITH GROMMET - (1) 42W x 24D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 52 x 24D SQUARE-EDGE RECTANGULAR RETURN - (1) 66W X 30D SQUARE-EDGE PENINSULA SURFACE, ROUNDED WITH SUPPORT POST LEG - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (1) 102W x 24H TACKBOARD - ALL LEGS: SQUARE OPEN SUPPORT LEGS (EXCEPT POST LEG) 	

FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012

MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	CROSSING - PORCELAIN 8T04

ADDITIONAL NOTES:
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

- ALTERNATE MANUFACTURERS:**
1. STEELCASE
 2. ALLSTEEL
 3. HAWORTH

FURNITURE KEY: O - 21
Location: WORKSTATION Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	APPROX 7'W x 12'-6"D x 5'8"H
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 72W x 30D RETURN WITH GROMMET - (1) 40W x 30D RETURN - (1) 72W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (1) 30W X 18D X 68H 2 DRAWER FILE CABINET WITH 3 BOOK SHELVES ABOVE - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4' 0" W CLEAR ENTRY - ALL LEGS: SQUARE OPEN SUPPORT LEGS

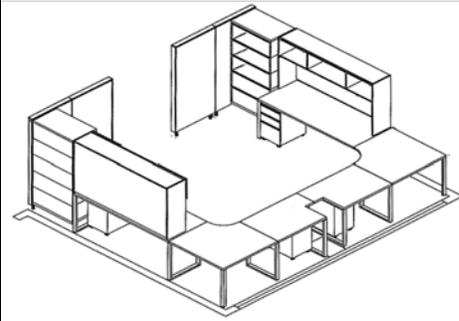


IMAGE ABOVE SHOWS TWO WORKSTATIONS

FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



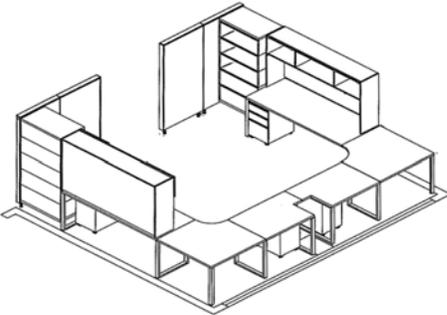
MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

- ALTERNATE MANUFACTURERS:**
1. STEELCASE
 2. ALLSTEEL
 3. HAWORTH

FURNITURE KEY: O - 22
Location: WORKSTATION Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER	 <p>IMAGE ABOVE SHOWS TWO WORKSTATIONS</p>
Name:	CANVAS	
Model #:	N / A	
Overall Dimensions:	APPROX 7"W x 12'-6"D x 5'8"H	
Features:	<p>ONE PERSON WORKSTATION:</p> <ul style="list-style-type: none"> - (1) 42W x 30D: SQUARE-EDGE CONCAVE CORNER WK SURFACE - (1) 72W x 30D RETURN WITH GROMMET (WITH CUSTOM CUT AROUND COLUMN) - (1) 40W x 30D RETURN - (1) 72W OPEN SHELVES ABOVE RETURN - (1) F/F MOBILE PEDESTAL - (1) B/B/F MOBILE PEDESTAL - (2) 68H TACKABLE PANELS @ ENTRY (ALLOW FOR 4'0" W CLEAR ENTRY - ALL LEGS: SQUARE OPEN SUPPORT LEGS 	

FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH
Upholstery:	CROSSING - PORCELAIN 8T04

GSA CONTRACT INFO	
Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012

MANUFACTURER'S REPRESENTATIVE:		 <p>CANYON ZEPHYR D1</p>
Name:	CINDY FARIAS	 <p>METALLIC BRONZE EH</p>
Email:	CINDY_FARIAS@HERMANMILLER.COM	 <p>CROSSING - PORCELAIN 8T04</p>
Business 1:	(312) 339-8578	
Business 2:	(312) 822-8473	

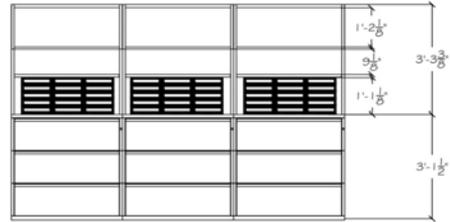
ADDITIONAL NOTES:
ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL. PROVIDE 30W x 4D x 68H SYSTEMS WING WALL PANEL BEHIND BOOKCASE TO SUPPORT (2) 68H TACKABLE PANELS AT ENTRY.

- ALTERNATE MANUFACTURERS:**
1. STEELCASE
 2. ALLSTEEL
 3. HAWORTH

FURNITURE KEY: O - 23
Location: C / P / F - 1st FLOOR Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	CANVAS
Model #:	N / A
Overall Dimensions:	84W x 24D x 76.875H
Features:	FREESTANDING MILLWORK UNIT: - (6) 24"D OPEN SHELVES BELOW COUNTER - (6) 12"D OPEN SHELVES ABOVE COUNTER - 30 THRIVE PAPER TRAY MAIL BOXES
FINISH:	
Worksurface:	CANYON ZEPHYR D1
Edge:	CANYON ZEPHYR D1
Metal Finish:	METALLIC BRONZE EH



SIMILAR TO IMAGE ABOVE

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



CANYON ZEPHYR D1



METALLIC BRONZE EH

MANUFACTURER'S REPRESENTATIVE:

Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473
Buisness 2:	(312) 822-8473

ADDITIONAL NOTES:

ALL SYSTEMS FURNITURE TO BE FULLY SELF-SUPPORTED. NO HOLES IN DRYWALL.

ALTERNATE MANUFACTURERS:

1. STEELCASE
2. ALLSTEEL
3. HAWORTH

FURNITURE KEY: S - 1

Location: GUEST CHAIR - FIRST AND THIRD FLOOR

Qty - 133 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	STEELCASE
Name:	MINGLE CHAIR
Model #:	MNGLB
Overall Dimensions:	19W x 18.5D x 18.5H
Features:	- BACK LEGS: 7026 NICKEL; FRONT LEGS: WOOD - WITH WOOD ARMS AND BACK - CUSTOM WOOD STAIN TO MATCH O-3 VENEER



FINISH:

Frame:	SEE FEATURES
Back:	MAPLE - CUSTOMIZ STAIN
Seat Upholstery:	KNOLL - PREP - K1076/3 - AQUA - GREENGUARD IAQ CERTIFIED - 100% RECYCLED POLYESTER

GSA CONTRACT INFO

Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014



WOOD STAIN: CUSTOM TO MATCH
HERMAN MILLER LIGHT ANIGRE EY

MANUFACTURER'S REPRESENTATIVE:

Name:	STACEY-HARLOE-MOWERY
Email:	SHARLOE1@STEELCASE.COM
Buisiness:	(312) 321-3771
Cell:	(312) 590-3328



SEAT UPHOLSTERY: KNOLL PREP - K1076/3 AQUA

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

1. COALESSE - ANDOO CHAIR
2. KNOLL - SHELTON MINDEL SIDE CHAIR

FURNITURE KEY: S - 2
Location: GUEST CHAIR - GROUND AND SECOND FLOOR **Qty - 150 TOTAL**

PRODUCT DESCRIPTION:		
Manufacturer:	STEELCASE	
Name:	MINGLE CHAIR	
Model #:	MNGLB	
Overall Dimensions:	19W x 18.5D x 18.5H	
Features:	- BACK LEGS: 7026 NICKEL; FRONT LEGS: WOOD - WITH WOOD ARMS AND BACK - CUSTOM WOOD STAIN TO MATCH O-3 VENEER	
FINISH:		
Frame:	SEE FEATURES	
Back:	MAPLE - CUSTOMIZ STAIN	
Seat Upholstery:	KNOLL - PREP - K1076/3 - AQUA - GREENGUARD IAQ CERTIFIED - 100% RECYCLED POLYESTER	
GSA CONTRACT INFO		
Contract #:	GS-27F-0014V	 <p>WOOD STAIN: CUSTOM TO MATCH HERMAN MILLER LIGHT ANIGRE EY</p>  <p>SEAT UPHOLSTERY: KNOLL PREP - K1076/6 CINNAMON</p>
Contract Duration:	THRU MARCH 12, 2014	
MANUFACTURER'S REPRESENTATIVE:		
Name:	STACEY-HARLOE-MOWERY	
Email:	SHARLOE1@STEELCASE.COM	
Buisiness:	(312) 321-3771	
Cell:	(312) 590-3328	
ADDITIONAL NOTES:		

- ALTERNATE MANUFACTURERS:**
1. COALESSE - ANDOO CHAIR
 2. KNOLL - SHELTON MINDEL SIDE CHAIR

FURNITURE KEY: S - 3
Location: DALD & ALD OFFICES Qty - 14 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	STEELCASE	
Name:	MINGLE CHAIR	
Model #:	MNGLB	
Overall Dimensions:	19W x 18.5D x 18.5H	
Features:	<ul style="list-style-type: none"> - BACK LEGS: 7026 NICKEL; FRONT LEGS: WOOD - WITH WOOD ARMS AND BACK - CUSTOM WOOD STAIN TO MATCH O-3 VENEER 	 <p>WOOD STAIN: CUSTOM TO MATCH HERMAN MILLER LIGHT ANIGRE EY</p>  <p>SEAT UPHOLSTERY: KNOLL PREP - K1076/3 AQUA</p>
FINISH:		
Frame:	SEE FEATURES	
Back:	MAPLE - CUSTOMIZ STAIN	
Seat Upholstery:	<ul style="list-style-type: none"> KNOLL - PREP - K1076/3 - AQUA - GREENGUARD IAQ CERTIFIED - 100% RECYCLED POLYESTER 	
GSA CONTRACT INFO		 <p>WOOD STAIN: CUSTOM TO MATCH HERMAN MILLER LIGHT ANIGRE EY</p>  <p>SEAT UPHOLSTERY: KNOLL PREP - K1076/3 AQUA</p>
Contract #:	GS-27F-0014V	
Contract Duration:	THRU MARCH 12, 2014	
MANUFACTURER'S REPRESENTATIVE:		 <p>WOOD STAIN: CUSTOM TO MATCH HERMAN MILLER LIGHT ANIGRE EY</p>  <p>SEAT UPHOLSTERY: KNOLL PREP - K1076/3 AQUA</p>
Name:	STACEY-HARLOE-MOWERY	
Email:	SHARLOE1@STEELCASE.COM	
Buisiness:	(312) 321-3771	
Cell:	(312) 590-3328	
ADDITIONAL NOTES:		

ALTERNATE MANUFACTURERS:

1. COALESSE - ANDOO CHAIR
2. KNOLL - SHELTON MINDEL SIDE CHAIR



FURNITURE KEY: S - 4 - NOT USED

Location: NOT USED

Qty - 0

PRODUCT DESCRIPTION:

Manufacturer:	
Name:	
Model #:	
Overall Dimensions:	
Features:	

FINISH:

Frame:	
Back:	
Seat Upholstery:	

GSA CONTRACT INFO

Contract #:	
Contract Duration:	

MANUFACTURER'S REPRESENTATIVE:

Name:	
Email:	
Buisiness:	

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

FURNITURE KEY: S - 5 - NOT USED
Location: NOT USED Qty - 0

PRODUCT DESCRIPTION:

Manufacturer:	
Name:	
Model #:	
Overall Dimensions:	
Features:	

FINISH:

Frame:	
Back:	
Seat Upholstery:	

GSA CONTRACT INFO

Contract #:	
Contract Duration:	

MANUFACTURER'S REPRESENTATIVE:

Name:	
Email:	
Buisiness:	

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

FURNITURE KEY: S - 6
Location: OPEN OFFICE - SECOND FLOOR Qty - 8 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	COALESSE / VECTA	
Name:	KART NESTING CHAIRS	
Model #:	126201S	
Overall Dimensions:	24.5W x 22.5D x 32.5 - 38H	
Features:	- WITH ARMS - WITH CASTERS	
FINISH:		
Frame:	POWDER COAT: 4140 PLATINUM MATTE	
Back:	BLACK 6400	
Seat Upholstery:	KNOLL - SOLILOQUY - K1458/9 - WILDFIRE - GREENGUARD IAQ CERTIFIED - 100% RECYCLED POLYESTER	
GSA CONTRACT INFO		
Contract #:	GS-27F-0014V	
Contract Duration:	THRU MARCH 12, 2014	
MANUFACTURER'S REPRESENTATIVE:		
Name:	JODI DYKSTRA	
Email:	JODI.DYKSTRA@COALESSE.COM	
Buisiness:	(312) 467-1783	
Cell:	(773) 332-4491	
		 BACK: BLACK 6400  SEAT UPHOLSTERY: SOLILOQUY - K1458/9 WILDFIRE  FRAME: 4140 PLATINUM MATTE
ADDITIONAL NOTES:		

ALTERNATE MANUFACTURERS:
1. HERMAN MILLER - SETU CHAIR
2. KNOLL - SAPPER CHAIR

FURNITURE KEY: S - 7
Location: OPEN OFFICE - THIRD FLOOR Qty - 8 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	COALESSE / VECTA
Name:	KART NESTING CHAIRS
Model #:	126201S
Overall Dimensions:	24.5W x 22.5D x 32.5 - 38H
Features:	- WITH ARMS - WITH CASTERS
FINISH:	
Frame:	POWDER COAT: 4140 PLATINUM MATTE
Back:	BLACK 6400
Seat Upholstery:	KNOLL - SOLILOQUY - K1458/6 - CORNFLOWER - GREENGUARD IAQ CERTIFIED - 100% RECYCLED POLYESTER
GSA CONTRACT INFO	
Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014
MANUFACTURER'S REPRESENTATIVE:	
Name:	JODI DYKSTRA
Email:	JODI.DYKSTRA@COALESSE.COM
Buisiness:	(312) 467-1783
Cell:	(773) 332-4491
ADDITIONAL NOTES:	
ALTERNATE MANUFACTURERS:	
1. HERMAN MILLER - SETU CHAIR	
2. KNOLL - SAPPER CHAIR	



BACK: BLACK 6400



SEAT UPHOLSTERY: SOLILOQUY - K1458/6 CORNFLOWER



FRAME: 4140 PLATINUM MATTE

FURNITURE KEY: S - 8
Location: STAFF LOUNGE Qty - 36 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	KNOLL
Name:	SPARK SIDE CHAIR
Model #:	4-C-SD-S-06
Overall Dimensions:	20.5W x 22D x 31H
Features:	- 40% RECYCLED CONTENT - WITH SEAT PAD



FINISH:

Frame:	RECYCLED BLACK 06
Back:	RECYCLED BLACK 06
Seat Upholstery:	MOMENTUM - SILICA - QUARTZ - GREENGUARD IAQ CERTIFIED - ZERO PVC - ZERO SOLVENTS

GSA CONTRACT INFO

Contract #:	GS-28F-8029H
Contract Duration:	THRU DECEMBER 12, 2012



SEAT UPHOLSTERY: MOMENTUM - SILICA - QUARTZ

MANUFACTURER'S REPRESENTATIVE:

Name:	DIANE MCCULLOUGH
Email:	DMCCULLO@KNOLL.COM
Buisiness:	(312) 454-7319

FRAME/BACK: RECYCLED BLACK 06

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

1. COALESSE - ENEA LOTTUS
2. KNOLL - X3

FURNITURE KEY: S - 9
Location: STAFF LOUNGE Qty - 4 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	STEELCASE - TURNSTONE
Name:	SCOOP STOOL
Model #:	TS30702
Overall Dimensions:	23W x 22D x 33H
Features:	- WITH SEAT PAD



FINISH:

Frame:	BLACK
Back:	COBBLESTONE 6682
Seat Upholstery:	MOMENTUM - SILICA - QUARTZ - GREENGUARD IAQ CERTIFIED - ZERO PVC - ZERO SOLVENTS

GSA CONTRACT INFO

Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014

MANUFACTURER'S REPRESENTATIVE:

Name:	STACEY-HARLOE-MOWERY
Email:	SHARLOE1@STEELCASE.COM
Buisiness:	(312) 321-3771
Cell:	(312) 590-3328



SEAT UPHOLSTERY: MOMENTUM - SILICA - QUARTZ



BACK: COBBLESTONE 6682

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

1. COALESSE - ENEA LOTTUS
2. KNOLL - X3

FURNITURE KEY: S - 10
Location: EXTERIOR TERRACE Qty - 12 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	LANDSCAPE FORMS
Name:	TRAVERSE
Model #:	SEE NOTES BELOW
Overall Dimensions:	20W x 24D x 30H
Features:	- PERFORATED SEAT - ARMLESS



FINISH:	
Frame:	PERFORATED METAL: SILVER
Back:	PERFORATED METAL: SILVER
Seat:	PERFORATED METAL: SILVER

GSA CONTRACT INFO

Contract #:	GS-27F-0016L
Contract Duration:	THRU APRIL 2, 2012

MANUFACTURER'S REPRESENTATIVE:

Name:	JENNIFER WOODS
Email:	JENNIFERW@LANDSCAPEFORMS.COM
Buisiness:	1-800-430-6206 xt.1336



BACK & SEAT: PERFORATED METAL

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

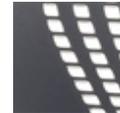
1. FORMS + SURFACES - VISTA
2. DESIGN WITHIN REACH - LUCCA DINING

FURNITURE KEY: S - 11
Location: SEMINAR, BREAKOUT Qty - 126 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	KNOLL
Name:	MULTIGENERATION
Model #:	2-S-A-S-X-GL
Overall Dimensions:	25.6W x 21.4D x 33.6H
Features:	- STACKING CHAIR - WITH FIXED ARMS - WITH GLIDES - WITH UPHOLSTERED SEAT PAD
FINISH:	
Frame:	4 SILVER
Shell:	DG DARK GREY
Seat:	MAHARAM - BITMAP - 466066 - 009 SLIT



GSA CONTRACT INFO	
Contract #:	GS-28F-8029H
Contract Duration:	THRU DECEMBER 12, 2012



BACK/SEAT: DG DARK GREY

MANUFACTURER'S REPRESENTATIVE:	
Name:	DIANE MCCULLOUGH
Email:	DMCCULLO@KNOLL.COM
Buisiness:	(312) 454-7319



FRAME: SILVER

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:
1. KI - XYLON
2. STEELCASE - CAPA

FURNITURE KEY: T - 1
Location: CONFERENCE ROOM Qty - 8 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	COALESSE
Name:	AKIRA
Model #:	AK6030RT
Overall Dimensions:	60W x 30D x 28.5H
Features:	- FIXED TOP - PROVIDE FLEX GANGERS - T BASE WITH CASTERS -WOOD VENEER TOP AND EDGE
FINISH:	
Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN
Edge:	FLAT WOOD EDGE TO MATCH TOP
Base:	PLATINUM MATTE 4141



GSA CONTRACT INFO	
Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014



WOOD TOP/EDGE FINISH: MEDIUM MAPLE, QUARTER CUT, LOW SHEEN

MANUFACTURER'S REPRESENTATIVE:	
Name:	JODI DYKSTRA
Email:	JODI.DYKSTRA@COALESSE.COM
Buisiness:	(312) 467-1783
Cell:	(773) 332-4491



BASE FINISH: PLATINUM MATTE 4141

ADDITIONAL NOTES:

- ALTERNATE MANUFACTURERS:**
1. KNOLL - PROPELLER TABLE
 2. HERMAN MILLER - EVERYWHERE TABLE

FURNITURE KEY: T - 2
Location: CONFERENCE ROOM Qty - 14 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	COALESSE	
Name:	AKIRA	
Model #:	AK6030RT	
Overall Dimensions:	60W x 30D x 28.5H	
Features:	<ul style="list-style-type: none"> - FIXED TOP - PROVIDE FLEX GANGERS - WOOD VENEER TOP AND EDGE - PROVIDE POWER, SEE NOTES BELOW - T BASE WITH CASTERS - PROVIDE HORIZONTAL AND VERTICAL WIRE 	
FINISH:		
Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN	 <p>WOOD TOP/EDGE FINISH: MEDIUM MAPLE, QUARTER CUT, LOW SHEEN</p>
Edge:	FLAT WOOD EDGE TO MATCH TOP	
Base:	PLATINUM MATTE 4141	
GSA CONTRACT INFO		 <p>BASE FINISH: PLATINUM MATTE 4141</p>
Contract #:	GS-27F-0014V	
Contract Duration:	THRU MARCH 12, 2014	
MANUFACTURER'S REPRESENTATIVE:		
Name:	JODI DYKSTRA	
Email:	JODI.DYKSTRA@COALESSE.COM	
Buisiness:	(312) 467-1783	
Cell:	(773) 332-4491	

ADDITIONAL NOTES:
 - INCLUDE TABLE POWER: ONE MINI-PORT WITH 10' CORD
 -TABLE POWER AT UPPER RIGHT CORNER

ALTERNATE MANUFACTURERS:
 1. KNOLL - PROPELLER TABLE
 2. HERMAN MILLER - EVERYWHERE TABLE

FURNITURE KEY: T - 3
Location: T-3 CONFERENCE ROOM - 3RD FLOOR Qty - 4 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	COALESSE
Name:	AKIRA
Model #:	AK7230RT
Overall Dimensions:	72W x 30D x 28.5H
Features:	- FIXED TOP - WITH MODESTY PANEL - PROVIDE FLEX GANGERS - T BASE WITH CASTERS -WOOD VENEER TOP AND EDGE
FINISH:	
Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN
Edge:	FLAT WOOD EDGE TO MATCH TOP
Base:	PLATINUM MATTE 4141
GSA CONTRACT INFO	
Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014
MANUFACTURER'S REPRESENTATIVE:	
Name:	JODI DYKSTRA
Email:	JODI.DYKSTRA@COALESSE.COM
Buisiness:	(312) 467-1783
Cell:	(773) 332-4491
	
 <p>WOOD TOP/EDGE FINISH: MEDIUM MAPLE , QUARTER CUT, LOW SHEEN</p>  <p>BASE FINISH: PLATINUM MATTE 4141</p>	
ADDITIONAL NOTES:	
ALTERNATE MANUFACTURERS:	
<ol style="list-style-type: none"> 1. KNOLL - PROPELLER TABLE 2. HERMAN MILLER - EVERYWHERE TABLE 	

FURNITURE KEY: T - 4
Location: CONFERENCE ROOM Qty - 4 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	COALESSE	
Name:	AKIRA	
Model #:	AK7230RT	
Overall Dimensions:	72W x 30D x 28.5H	
Features:	<ul style="list-style-type: none"> - FIXED TOP - WITH MODESTY PANEL - PROVIDE FLEX GANGERS - WOOD VENEER TOP AND EDGE - PROVIDE POWER, SEE NOTES BELOW - T BASE WITH CASTERS - PROVIDE HORIZONTAL AND VERTICAL WIRE MANAGER 	
FINISH:		 <p>WOOD TOP/EDGE FINISH: MEDIUM MAPLE , QUARTER CUT, LOW SHEEN</p>  <p>BASE FINISH: PLATINUM MATTE 4141</p>
Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN	
Edge: Base:	FLAT WOOD EDGE TO MATCH TOP PLATINUM MATTE 4141	
GSA CONTRACT INFO		
Contract #:	GS-27F-0014V	
Contract Duration:	THRU MARCH 12, 2014	
MANUFACTURER'S REPRESENTATIVE:		
Name:	JODI DYKSTRA	
Email:	JODI.DYKSTRA@COALESSE.COM	
Buisness: Cell:	(312) 467-1783 (773) 332-4491	
ADDITIONAL NOTES:		
- INCLUDE TABLE POWER: ONE MINI-PORT WITH 10' CORD		
-TABLE POWER AT UPPER RIGHT CORNER		
ALTERNATE MANUFACTURERS:		
1. KNOLL - PROPELLER TABLE		
2. HERMAN MILLER - EVERYWHERE TABLE		

FURNITURE KEY: T - 5
Location: BREAK ROOM Qty - 9 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	LOEWENSTEIN
Name:	TABLES & BASES
Model #:	TOP: SPECIAL - SEE BELOW BASE: 5520 - 22 - A2K
Overall Dimensions:	42 DIA x 28.5H
Features:	- TOP: 42 DIA ROUND TOP - BASE: SQUARE, DINING HEIGHT, STAINLESS STEEL
FINISH:	
Top:	SPECIAL: VETRAZZO - CUBIST CLEAR
Edge:	SPECIAL: VETRAZZO - CUBIST CLEAR
Base:	5520-22 STAINLESS STEEL
GSA CONTRACT INFO	
Contract #:	GS-28F-0003L
Contract Duration:	THRU OCTOBER 19, 2010
MANUFACTURER'S REPRESENTATIVE:	
Name:	CHARLENE RHEAULT
Email:	CRHEAULT@OFSBRANDS.COM
Buisness:	(312) 576-8563
ADDITIONAL NOTES:	



TOP/EDGE FINISH: VETRAZZO - CUBIST CLEAR



BASE FINISH: 22 STAINLESS STEEL

ALTERNATE MANUFACTURERS:
1. BALTIX SUSTAINABLE TABLES
2. COALESSE - ENEA TABLE

FURNITURE KEY: T - 6
Location: C / P / F ROOM Qty - 2 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	EVERYWHERE TABLE
Model #:	DT1A-30-72-L-P-28-EH-57
Overall Dimensions:	72W X 30D X 28.5H
Features:	-LAMINATE TOP - WITH GLIDES



FINISH:	
Top:	CANYON ZEPHYR 28
Edge:	CANYON ZEPHYR 28
Base:	METALLIC BRONZE EH

GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



TOP/EDGE FINISH: CANYON ZEPHYR 28

MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisiness 1:	(312) 339-8578
Buisiness 2:	(312) 822-8473



BASE FINISH: METALLIC BRONZE

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

1. STEELCASE - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
2. ALLSTEEL - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: T - 7
Location: C / P / F ROOM Qty - 5 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	EVERYWHERE TABLE	
Model #:	DT1A-30-48-L-P-28-EH-57	
Overall Dimensions:	48W X 30D X 28.5H	
Features:	-LAMINATE TOP - WITH GLIDES	
FINISH:		
Top:	CANYON ZEPHYR 28	 <p>CANYON ZEPHYR D1</p>  <p>METALLIC BRONZE EH</p>
Edge:	CANYON ZEPHYR 28	
Base:	METALLIC BRONZE EH	
GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	
Contract Duration:	THRU DECEMBER 31, 2012	
MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisiness 1:	(312) 339-8578	
Buisiness 2:	(312) 822-8473	
ADDITIONAL NOTES:		

- ALTERNATE MANUFACTURERS:**
1. STEELCASE - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 2. ALLSTEEL - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: T - 8

Location: CONFERENCE ROOM

Qty - 2 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	COALESSE
Name:	AKIRA
Model #:	AK7230RT
Overall Dimensions:	72W x 30D x 28.5H
Features:	- FIXED TOP -WOOD VENEER TOP AND EDGE - PROVIDE FLEX GANGERS -WITH CASTERS



FINISH:

Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN
Edge:	FLAT WOOD EDGE TO MATCH TOP
Base:	PLATINUM MATTE 4141

GSA CONTRACT INFO

Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014

MANUFACTURER'S REPRESENTATIVE:

Name:	JODI DYKSTRA
Email:	JODI.DYKSTRA@COALESSE.COM
Buisness:	(312) 467-1783
Cell:	(773) 332-4491



WOOD TOP/EDGE FINISH: MEDIUM MAPLE , QUARTER CUT, LOW SHEEN



FRAME FINISH: PLATINUM MATTE 4141

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

1. KNOLL - PROPELLER TABLE
2. HERMAN MILLER - EVERYWHERE TABLE

FURNITURE KEY: T - 9
Location: CONFERENCE ROOM Qty - 2 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	COALESSE	
Name:	AKIRA	
Model #:	AK7230RT	
Overall Dimensions:	72W x 30D x 28.5H	
Features:	<ul style="list-style-type: none"> - FIXED TOP -WOOD VENEER TOP AND EDGE - PROVIDE FLEX GANGERS - PROVIDE POWER, SEE NOTES BELOW -WITH CASTERS - PROVIDE HORIZONTAL AND VERTICAL WIRE 	
FINISH:		
Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN	
Edge:	FLAT WOOD EDGE TO MATCH TOP	
Base:	PLATINUM MATTE 4141	

GSA CONTRACT INFO

Contract #:	GS-27F-0014V	
Contract Duration:	THRU MARCH 12, 2014	

MANUFACTURER'S REPRESENTATIVE:

Name:	JODI DYKSTRA	<p>WOOD TOP/EDGE FINISH: MEDIUM MAPLE , QUARTER CUT, LOW SHEEN</p>  <p>BASE FINISH: PLATINUM MATTE 4141</p>
Email:	JODI.DYKSTRA@COALESSE.COM	
Buisness:	(312) 467-1783	
Cell:	(773) 332-4491	

ADDITIONAL NOTES:

- INCLUDE TABLE POWER: ONE MINI-PORT WITH 10' CORD
- TABLE POWER AT UPPER RIGHT CORNER

ALTERNATE MANUFACTURERS:

1. KNOLL - PROPELLER TABLE
2. HERMAN MILLER - EVERYWHERE TABLE

FURNITURE KEY: T - 10
Location: OFFICE WORK TABLE Qty - 1 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	EVERYWHERE TABLE	
Model #:	DT1C-36-L-P-28-EH-57	
Overall Dimensions:	36 DIA.	
Features:	-LAMINATE TOP - WITH GLIDES	
FINISH:		
Top:	CANYON ZEPHYR 28	 <p>TOP FINISH: CANYON ZEPHYR D1</p>  <p>BASE FINISH: METALLIC BRONZE EH</p>
Edge:	CANYON ZEPHYR 28	
Base:	METALLIC BRONZE EH	
GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	
Contract Duration:	THRU DECEMBER 31, 2012	
MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	
ADDITIONAL NOTES:		

- ALTERNATE MANUFACTURERS:**
1. STEELCASE - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 2. ALLSTEEL - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

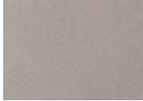
FURNITURE KEY: T - 11
Location: OPEN OFFICE TABLE Qty - 4 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	EVERYWHERE TABLE	
Model #:	DT1C-42-L-P-28-EH-57	
Overall Dimensions:	42 DIA.	
Features:	-LAMINATE TOP - WITH GLIDES	
FINISH:		
Top:	CANYON ZEPHYR 28	
Edge:	CANYON ZEPHYR 28	
Base:	METALLIC BRONZE EH	
GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	 <p>TOP FINISH: CANYON ZEPHYR D1</p>  <p>BASE FINISH: METALLIC BRONZE EH</p>
Contract Duration:	THRU DECEMBER 31, 2012	
MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	
Email:	CINDY_FARIAS@HERMANMILLER.COM	
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	
ADDITIONAL NOTES:		
ALTERNATE MANUFACTURERS:		
1. STEELCASE - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES		
2. ALLSTEEL - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES		

FURNITURE KEY: T - 12
Location: DALD OFFICE AND CONFERENCE ROOM Qty - 1 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	HERMAN MILLER	
Name:	EVERYWHERE TABLE	
Model #:	DT1C-48-W-P-EY-EH-57	
Overall Dimensions:	48 DIA.	
Features:	- VENEER - PROVIDE POWER, SEE NOTES BELOW - WITH GLIDES - PROVIDE CABLE MANAGEMENT CLIP	
FINISH:		
Top:	LIGHT ANIGRE EY	
Edge:	LIGHT ANIGRE EY	
Base:	METALLIC BRONZE EH	

GSA CONTRACT INFO		
Contract #:	GS - 28F - 8049H	
Contract Duration:	THRU DECEMBER 31, 2012	

MANUFACTURER'S REPRESENTATIVE:		
Name:	CINDY FARIAS	
Email:	CINDY_FARIAS@HERMANMILLER.COM	WOOD TOP/EDGE FINISH: LIGHT ANIGRE
Buisness 1:	(312) 339-8578	
Buisness 2:	(312) 822-8473	BASE FINISH: METALLIC BRONZE EH

ADDITIONAL NOTES:
 - INCLUDE TABLE POWER: HM CONNECT--S100 WITH PLUG END, 10' CORD/CONDUIT/PVC-FREE WIRING; MODEL # Y1321-A-10-LZ-OH
 - CENTER TABLE POWER WIDTH AND DEPTH WISE

ALTERNATE MANUFACTURERS:
 1. STEELCASE - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
 2. ALLSTEEL - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: T - 13
Location: ALD OFFICE Qty - 1 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	HERMAN MILLER
Name:	EVERYWHERE TABLE
Model #:	DT1A-30-60-W-P-EY-EH-57
Overall Dimensions:	60W x 30D
Features:	-VENEER - PROVIDE POWER, SEE NOTES BELOW - WITH GLIDES - PROVIDE CABLE MANAGEMENT CLIP
FINISH:	
Top:	LIGHT ANIGRE EY
Base:	METALLIC BRONZE EH
Edge:	LIGHT ANIGRE EY



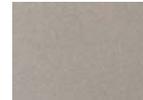
GSA CONTRACT INFO

Contract #:	GS - 28F - 8049H
Contract Duration:	THRU DECEMBER 31, 2012



WOOD TOP/EDGE FNISH: LIGHT ANIGRE EY

MANUFACTURER'S REPRESENTATIVE:	
Name:	CINDY FARIAS
Email:	CINDY_FARIAS@HERMANMILLER.COM
Buisness 1:	(312) 339-8578
Buisness 2:	(312) 822-8473



BASE FINISH: METALLIC BRONZE EH

ADDITIONAL NOTES:

- INCLUDE TABLE POWER: HM CONNECT--S100 WITH PLUG END, 10' CORD/CONDUIT/PVC-FREE WIRING; MODEL # Y1321-A-10-LZ-OH
- CENTER TABLE POWER WIDTH AND DEPTH WISE

ALTERNATE MANUFACTURERS:

1. STEELCASE - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES
2. ALLSTEEL - TABLE MUST MATCH FINAL SYSTEMS FURNITURE MANUFACTURER AND SERIES

FURNITURE KEY: T - 14

Location: T-14 EXTERIOR TERRACE TABLE, 2ND FLOOR

Qty - 3 TOTAL

PRODUCT DESCRIPTION:

Manufacturer:	LANDSCAPE FORMS
Name:	CATENA METAL TABLE
Model #:	SEE NOTES BELOW
Overall Dimensions:	42 DIA. x 29H
Features:	- FREESTANDING BASE



FINISH:

Top:	POWDERCOAT TABLE TOP : SILVER
Base:	POWDERCOAT TABLE TOP : SILVER

GSA CONTRACT INFO

Contract #:	GS-27F-0016L
Contract Duration:	THRU APRIL 2, 2012

MANUFACTURER'S REPRESENTATIVE:

Name:	JENNIFER WOODS
Email:	JENNIFERW@LANDSCAPEFORMS.COM
Business 1:	1-800-430-6206 xt.1336



TOP AND BASE FINISH: SILVER

ADDITIONAL NOTES:

ALTERNATE MANUFACTURERS:

1. FORMS + SURFACES - COLUMN TABLE
2. DESIGN WITHIN REACH - LUCCA DINING

FURNITURE KEY: T - 15
Location: INTERACTION SPACE Qty - 3 TOTAL

PRODUCT DESCRIPTION:		
Manufacturer:	LOEWENSTEIN	
Name:	TABLES & BASES	
Model #:	TOP: 43000 - 36RNDT BASE: 5520 - 22 - A2L	
Overall Dimensions:	36DIA x 40.75H	
Features:	- TOP: ROUND VENEER - BASE: SQUARE, BAR HEIGHT, STAINLESS STEEL	
FINISH:		
Top:	MHM HONEY MAPLE - STRAIGHT GRAIN FINISH	
Edge:	43000 - SOFT EDGE A7A, MHM HONEY MAPLE	
Base:	5520 - 22 STAINLESS STEEL	
GSA CONTRACT INFO		
Contract #:	GS-28F-0003L	
Contract Duration:	THRU OCTOBER 19, 2010	
MANUFACTURER'S REPRESENTATIVE:		
Name:	CHARLENE RHEULT	 WOOD TOP/EDGE FINISH: MHM - HONEY MAPLE  BASE FINISH: 22 STAINLESS STEEL
Email:	CRHEULT@OFSBRANDS.COM	
Buisness:	(312) 576-8563	
ADDITIONAL NOTES:		

- ALTERNATE MANUFACTURERS:**
1. COALESSE - ENEA
 2. HERMAN MILLER - EVERYWHERE TABLE

FURNITURE KEY: T - 16
Location: CONFERENCE ROOM Qty - 1 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	COALESSE
Name:	AKIRA
Model #:	AK7236RT
Overall Dimensions:	72W x 36D x 28.5H
Features:	- FIXED TOP -WOOD VENEER TOP AND EDGE - PROVIDE POWER, SEE NOTES BELOW -T BASE WITH GLIDES - PROVIDE HORIZONTAL AND VERTICAL WIRE
FINISH:	
Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN
Edge:	FLAT WOOD EDGE TO MATCH TOP
Base:	PLATINUM MATTE 4141
GSA CONTRACT INFO	
Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014
MANUFACTURER'S REPRESENTATIVE:	
Name:	JODI DYKSTRA
Email:	JODI.DYKSTRA@COALESSE.COM
Buisness:	(312) 467-1783
Cell:	(773) 332-4491



WOOD TOP/EDGE FINISH: MEDIUM MAPLE , QUARTER CUT, LOW SHEEN



BASE FINISH: PLATINUM MATTE 4141

ADDITIONAL NOTES:
- INCLUDE TABLE POWER: ONE MINI-PORT WITH 10' CORD
- CENTER TABLE POWER WIDTH AND DEPTH WISE

ALTERNATE MANUFACTURERS:
1. KNOLL - PROPELLER TABLE
2. HERMAN MILLER - EVERYWHERE TABLE

FURNITURE KEY: T - 17
Location: SEMINAR/BREAKOUT ROOMS Qty - 40 TOTAL

PRODUCT DESCRIPTION:	
Manufacturer:	COALESSE
Name:	AKIRA
Model #:	AKF6024RLC
Overall Dimensions:	60W x 24D x 28.5H
Features:	- FLIP TOP - WITH MODESTY PANEL - PROVIDE FLEX GANGERS - T BASE WITH CASTERS -WOOD VENEER TOP AND EDGE
FINISH:	
Top:	MEDIUM MAPLE - QUARTER CUT - LOW SHEEN
Edge:	FLAT WOOD EDGE TO MATCH TOP
Base:	PLATINUM MATTE 4141
GSA CONTRACT INFO	
Contract #:	GS-27F-0014V
Contract Duration:	THRU MARCH 12, 2014
MANUFACTURER'S REPRESENTATIVE:	
Name:	JODI DYKSTRA
Email:	JODI.DYKSTRA@COALESSE.COM
Buisiness:	(312) 467-1783
Cell:	(773) 332-4491
ADDITIONAL NOTES:	
ALTERNATE MANUFACTURERS:	
1. KNOLL - PROPELLER TABLE	
2. HERMAN MILLER - EVERYWHERE TABLE	



WOOD TOP/EDGE FINISH: MEDIUM MAPLE , QUARTER CUT, LOW SHEEN



BASE FINISH: PLATINUM MATTE 4141

END OF SECTION

SECTION 12 24 14

ROLLER SHADES

PART 1 - GENERAL

1.1 REFERENCES

- A. ASTM-G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA-70, National Electrical Code.
- C. NFPA-701-99, Fire Tests for Flame-Resistant Textiles and Films.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
 - 2. Prepare shop drawings on Autocad format using base sheets provided electronically by the Architect.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
 - c. Storage and handling requirements and recommendations.
 - d. Mounting details and installation methods.
 - e. Window Treatment Schedule: For roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- C. Samples:
 - 1. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
 - 2. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.
- D. Contract Closeout Information:
 - 1. Maintenance Data:
 - a. Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
 - 2. Warranty:
 - a. Roller shade and control systems: Manufacturer's standard non-depreciating 5-year warranty shall be provided.
 - 3. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.

- E. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- B. 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.
- C. Fire-Test-Response Characteristics: Passes NFPA-701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Anti-Microbial Characteristics: 'No Growth' per ASTM-G21 results for fungi ATCC 9642, ATCC 9644, and ATCC 9645.
- E. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories:
 - 1. Locate mock-up in window designated by Architect.
 - 2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.6 EXTRA MATERIAL

- A. Furnish extra materials that match products installed:
 - 1. Package extra materials with protective covering for storage and label to describe contents.
 - 2. Provide 5 percent additional shade cloth fabric of each type for Laboratory's attic stock.

1.7 WARRANTY

- A. Roller Shade Hardware, Chain and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Roll shades:
 - a. MechoShade Systems:
 - 1) Basis of Design, MechoShade Mecho/5.

- 2) Alternate manufacturer's:
 - a) Silent Gliss.
 - b) Solarfective.

2.2 APPLICATIONS/SCOPE

A. Roller Shade Schedule:

1. Shade Type SH-1: Manual operating, chain drive, sunscreen roller shades in exterior windows per the following:
 - a. North facing:
 - 1) Shade to cover entire window except upper portion, see A-300 series sheets for detail.
 - b. East facing:
 - 1) Base Proposal: no shades
 - 2) Alt 2: shades at southeast corner rooms; shade to cover entire window except upper portion, see A-300 series sheets for detail.

AD-4: Section 12 24 14: Add paragraph 2.2.A.1.b.3.

- 3) Alt 9: No shades
- c. South facing:
 - 1) Shade to cover entire window except upper portion, see A-300 series sheets for detail.
- d. West facing:
 - 1) Offices and Vestibule: shade to cover entire window except upper portion, see A-300 series sheets for detail.
 - 2) Open Office C204: separate shade at upper portion and lower portion of windows, independently operating.

AD-4: Section 12 24 14: Add paragraph 2.2.1.d.3.

- 3) Alt 9: shade at all windows at First and Second Floor.
2. Shade Type SH-2: Motorized operating, chain drive, sunscreen roller shades, operating independently of each other, in exterior windows of Open Office C305, full height.

AD-4: Section 12 24 14: Add paragraph 2.2.3.

3. Shade Type SH-3: Manual operating, chain drive blackout roller shade with fascia and room darkening side channels. See Door and Frame Schedule A-603 through A-609 for locations.
 - a. Blackout shades at doors to have tension cables so shade does not flap when door is in movement.

2.3 SHADE CLOTH

- A. SH-1 and SH-2: Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., Thermoveil group, 1300 series, dense basket-weave, 5 percent OF (openness factor).
- B. Color as indicated on Room Finish Schedule Key.
 1. Color: Selected from manufacturer's standard colors.

AD-4: Section 12 24 14: Add paragraph 2.3.C.

- C. SH-3: Blackout roller shade: MechoShade Systems, Inc., Equinox 0100 series shadecloth.

2.4 SHADE BAND

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable:
 1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for shades within one room.

2. Shade band and Shade Roller Attachment:
 - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
 - b. Provide for positive mechanical engagement with drive / brake mechanism.
 - c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
 - d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
 - e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.5 SHADE FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
 1. Bottom hem weights for concealed hem tube.

2.6 COMPONENTS

- A. Access and Material Requirements:
 1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
- B. Manual Operated Chain Drive Hardware and Brackets:
 1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for shade drive end brackets. Universal offset shall be adjustable for future change.
 2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
 3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
 4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
 5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
 6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
 7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
 8. Drive Bracket / Brake Assembly:
 - a. MechoShade Drive Bracket model M5 shall be fully integrated with MechoShade accessories, including, but not limited to: SnapLoc fascia, center supports and connectors for multi-banded shades.
 - b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.

- c. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
- d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
- e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

2.7 SHADE MOTOR DRIVE SYSTEM

- A. Shade Motors:
 - 1. Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
 - 2. Conceal motors inside shade roller tube.
 - 3. Maximum current draw for each shade motor of 2.3 amps.
 - 4. Use motors rated at the same nominal speed for shades in the same room.
- B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly.

2.8 MOTOR CONTROL SYSTEMS

- A. IQ/MLC: Specifications and design of shade motors and motor control system are based on the IQ/MLC motor logic control system manufactured by MechoShade Systems, Inc. Other systems may be acceptable provide that of the following performance capabilities are provided. Motor logic control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.
 - 1. Motor Control System:
 - a. Provide power to each shade motor via individual 3 conductor line voltage circuits connecting each motor to the relay based motor logic controllers (IQ/MLC).
 - b. Control system components shall provide appropriate (spike and brown out) over-current protection (+/- 10 percent of line voltage) for each of the four individual motor circuits and shall be rated by UL or ETL as a recognized component of this system and tested as an integrated system.
 - c. Motor control system shall allow each group of four shade motors in any combination to be controlled by each of four local switch ports, with up to fourteen possible "sub-group" combinations via local 3 button wall switches and at once via a master 3 button switch. System shall allow for overlapping switch combinations from two or more local switches.
 - d. Multiple "sub-groups" from different IQ/MLC control components shall be capable of being combined to form "groups" operated by a single 3 button wall switch, from either the master port or in series from a local switch port.
 - e. Each shade motor shall be accessible (for control purposes) from up to four local switches and one master switch.
 - f. Control system shall allow for automatic alignment of shade hem bars in stopped position at 25 percent, 50 percent, and 75 percent of opening heights, and up to three user-defined intermediate stopping positions in addition to all up / all down, regardless of shade height, for a total of five positions. Control system shall allow shades to be stopped at any point in the opening height noting that shades may not be in alignment at these non-defined positions).

- g. Control system shall have two standard operating modes: Normal mode allowing the shades to be stopped anywhere in the window's opening height and uniform mode, allowing the shades to only be stopped at the predefined intermediate stop positions. Both modes shall allow for all up / all down positioning.
 - h. Control system components shall allow for interface with both audiovisual system components and building fire and life safety system via a dry contact terminal block.
 - i. Control system components shall allow for interface with external analog input control devices such as solar activated controllers, 24 hour timers, and similar items; via a dry contact terminal block.
 - j. Reconfiguration of switch groups shall not require rewiring of the hardwired line voltage motor power supply wiring, or the low voltage control wiring. Reconfiguration of switch groups shall be accomplished within the motor control device (IQ/MLC).
2. Wall Switches:
- a. Three-button architectural flush mounted switches with metal cover plate and no exposed fasteners.
 - b. Connect local wall switches to control system components via low voltage (12V DC) 4-conductor modular cable equipped with RJ-11 type connectors supplied, installed and certified under Electrical Specification Divisions.
 - c. Connect master wall switches to control system components via low voltage (12V DC) 6-conductor modular cable equipped with RJ-12 type connectors supplied, installed and certified under Electrical Specification Divisions.

2.9 ACCESSORIES

- A. Fascia for Shade Type SH-1 and SH-2:
- 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
 - 2. Fascia shall be able to be installed across two or more shade bands in one piece.
 - 3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
 - 4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
 - 5. Notching of Fascia for manual chain shall not be acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare 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 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 Laboratory's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

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

END OF SECTION

SECTION 12 34 00
ARCHITECTURAL CASEWORK (AC) (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Architectural Casework (AC), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Work includes:
 - 1. Provide labor, materials, tools, equipment, and services for laminate faced architectural casework (AC) as indicated in A-series drawings, plans and elevations, for both plastic laminate and wood veneer-faced, standard and custom configurations as indicated.
 - 2. Completely coordinate with work of other trades.
 - 3. Although such work is not specifically indicated, provide supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation, including, but not limited to accompanying countertops and brackets, and surrounds.
 - 4. See Division 01 for General Requirements.
- B. Verify dimensions at site.
- C. Note the use of solid recycled glass PCC countertops. Verify the weight of countertop material and reinforce casework as necessary to safely support countertops.
- D. Verify locations of items furnished in other sections.
- E. If necessary to vary from arrangement indicated because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect.
- F. See Drawings for types of countertops required.
- G. Definitions:
 - 1. Exposed surfaces: Surfaces visible after installation.
 - 2. Concealed surfaces: Surfaces not visible after installation.
 - 3. Semi exposed surfaces: Surfaces not meeting the definition of exposed or concealed, including the interiors of drawer and door components.
- H. Installer qualifications: Manufacturer, or manufacturer's authorized representative.
- I. Construction details, fastening, tolerances and workmanship:
 - 1. Comply with applicable provisions of Architectural Woodwork Quality Standards Illustrated by AWI, current edition.
 - a. Grade: Premium, with exceptions indicated.
 - 2. All exposed cabinet body edges are to be fabricated flush before and after installation of edge banding.
 - 3. All surfaces to be smooth, without protrusions, and cleanable.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Plans and elevations:
 - a. Plans of casework at 1/8 IN = 12 IN or larger.
 - b. Elevations of casework at 1/4 IN = 1 FT or larger.

- c. Cross reference shop drawings to Construction Drawing casework elevation reference numbers.
- B. Samples:
 - 1. Sealant colors for selection.
 - 2. Hardware.
 - 3. Mock-up cabinet (may be incorporated into project if accepted).
- C. Contract Closeout Information:
 - 1. Operating and maintenance data.
 - 2. Warranty.
- D. Extra Material:
 - 1. Turn over to Laboratory "extra" casework door locks and drawer locks that were not shown to be installed in drawings, or were installed where directed by Laboratory. See Part 3 for additional information.
- E. LEED Information:
 - 1. MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 & 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. MR 7, Certified Wood: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood obtained from forests certified by an FSC-accredited certification agency 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.
 - 4. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.
 - 5. EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Manufacturers' product data for each composite wood product used indicating that the bonding agent used contains no urea formaldehyde.

1.4 WARRANTY

- A. Provide Manufacturer five (5) year warranty against defects in materials and workmanship, such as but not limited to delamination, swelling, or warping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Architectural Casework:
 - 1. Base:
 - a. TMI Systems Design.
 - b. Calmar Manufacturing (Tru-Bilt).
 - c. Techline.
 - 2. The apparent successful bidder shall provide the following prior to submittal of Shop Drawings:
 - a. Sample of finished base cabinet unit, 18 IN wide minimum, with one drawer, door and shelf, complete with hardware conforming to requirements.
 - b. Catalog of standard units detailing construction and assembly of components.
 - c. If not acceptable, construct additional sample cabinets.
 - d. Sample cabinet constitutes standard of quality for actual construction.

- e. Maintain approved sample at job office during construction, as basis for Architect's acceptance of remainder of work.
 - f. Sample cabinet may be incorporated into the work if accepted and protected throughout construction.
- B. Plastic Laminate:
- 1. Base:
 - a. Formica.
 - b. Nevamar.
 - c. Wilsonart.
- C. Plastic Overlay Panel products:
- 1. Base:
 - a. Simpson Timber.; Shelton, WA.
 - b. Selply.; White City, OR.
 - c. Casework Manufacturer.
- D. Particleboard (Formaldehyde-free):
- 1. Base:
 - a. Columbia Forest Products.
 - 2. Optional:
 - a. Roseburg Forest Products.
 - b. Sierra Pine
 - c. Temple Inland.
- E. Particleboard, FSC Certified:
- 1. Base:
 - a. Columbia Forest Products.
 - 2. Optional:
 - a. Collins Company

AD-4:

- F. Cabinet Pulls:
- 1. Base:
 - a. Sugatsune America
 - 2. Optional:
 - a. Hafele
 - b. Frost Design
- G. Other Cabinet Hardware:
- 1. Base:
 - a. Hafele
 - 2. Optional:
 - a. Accuride.
 - b. Epc; Flint, MI.
 - c. Hafele.
 - d. Blum.
 - e. Knape & Vogt.
 - f. Grant; West Hyack, NY.
 - g. National Lock; Mauldin, SC.
 - h. Ilco Unican Corporation.
 - i. Stanley Hardware.
 - j. Stylmark; Minneapolis, MN.
 - k. HEWI.
 - l. LSI America.
 - m. TMI Systems Design.
 - n. Rockford Process Control; Rockford, IL.
 - o. U.S. Futaba; Santa Ana, CA.

- p. Rohm & Haas.
 - q. Weber Knapp Company, Jamestown, NY.
 - r. Corbin Cabinet Lock Div.
 - s. Schlage Lock.
 - t. Olympus Lock; Seattle, WA.
 - u. Sugatsune America, (Lamp); Carson, CA.
 - v. Bull Dog Lock.; Chicago, IL.
 - w. Colson Caster Corporation; Jonesboro, AR.
 - x. PX Industries; Farmingdale, NY.
- H. Sealant:
- 1. Base:
 - a. Color Rite.
- I. Other miscellaneous items:
- 1. Base: Products and Manufacturers as listed.
- J. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Plastic Laminate-Faced Casework:
- 1. Fixed factory built particleboard core casework finished on exterior with high pressure laminate. Interior of plastic laminate faced units with plastic overlay. Provide units complete with hardware, countertops and subbases, in sizes and configurations indicated. Refer to Fabrication requirements in Part II of this specification.
 - a. Style:
 - 1) Reveal overlay, with square cornered doors and drawer fronts overlapping case front with minimum reveal at plastic laminate casework.
 - 2) Plastic laminate doors and drawer fronts shall be edged with 3mm PVC banding, machine applied using waterproof hot melt adhesive. Machine profile exposed edges with 1/8 IN radius.
 - b. Joinery:
 - 1) Cabinet body construction shall be 3/4 IN thick particleboard core joined with 10mm diameter industrial grade hardwood dowels, securely glued and clamped under pressure during assembly.
- B. Particleboard, Formaldehyde-free.
- 1. ANSI-A201.1, mat formed.
 - 2. Density: 720 KG M² 45 PCF.
 - 3. Type 1-M-3 for general use.
- C. Medium Density Fiberboard (MDF):
- 1. Meet or exceed ANSI 1037-87.
 - 2. Exterior grade, 48 PCF density, formaldehyde free.
 - 3. Base: Medite Corporation "MEDEX"; Medford, OR. (800/676-3339) or equal.
 - 4. Core material for counters, backsplash, and sidesplashes with sinks.
 - 5. Core material for p-lam faced window sills where indicated.
- D. Plastic Laminate Facings:
- 1. Standard: NEMA LD3-1991 high-pressure decorative laminate (HPDL).
 - 2. Thickness and Grade:
 - a. Formed surfaces: Post form Grade-PF42.
 - b. Other exposed surfaces: Grade-GP28, 0.028 IN thick.
 - 3. Backer Sheets for laminated items.
 - a. Semi-exposed cabinet liner: Grade-CL20, 0.020 IN thick; color to match plastic overlay.
 - b. Concealed backer sheet: Grade-BK20, 0.020 IN thick.
 - 4. Laminate Color(s): as selected by Architect from laminate manufacturer's full line.

- a. See color schedule for selections (Section 09 06 10).
 - b. Allow for 3 different cabinet face colors for project; no more than 1 color per each elevation.
 - c. Color of other plastic laminate edges: Black or to match plastic overlay, as selected by Architect.
5. See "Fabrication-Case Components" for components requiring plastic laminate finish.
- E. Plastic Overlay:
- 1. Resin impregnated 80 gram paper overlay, glued and press cured onto substrate.
 - 2. Conform to NEMA LD3.3 wear resistance Grade-GP28 requirements for "General Purpose" decorative board (not "Light Duty" liner type).
 - 3. Finish: Satin.
 - 4. Color: As selected by Architect from manufacturer's standard color line of dove gray, frosty white and light beige.
 - 5. Material: Polyester or Melamine; phenolic resin may be used on concealed surfaces.
 - 6. Substrates: As indicated below; see "Fabrication- Case Components" for components requiring plastic overlay finish.
- F. PVC Edge-banding for case body & components:
- 1. Machine applied with waterproof hot-melt adhesive.
 - 2. Thickness: 1mm.
 - 3. Color: To match case, as selected by Architect.
- G. PVC edge banding (all shelves in plastic laminate clad units):
- 1. Machine applied with waterproof hot-melt adhesive.
 - 2. Shelves: Apply to 4 edges.
 - 3. Thickness: 1mm.
 - 4. Color: To match case, as selected by Architect.
- H. PVC Edge-banding for doors and drawer fronts and removable panels:
- 1. Machine applied with waterproof hot-melt adhesive.
 - 2. Thickness: 3mm.
 - 3. See color schedule for selections (Section 09 06 10).
 - 4. Color: As selected by Architect, to match laminate.
 - a. Allow for 5 different colors.
- I. Adhesives:
- 1. Comply with South Coast Air Quality Management Rule 1168.
 - 2. Contact adhesives shall have a VOC content no greater than 80g/l.
- J. Sealant (elastomeric):
- 1. Description:
 - a. Mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.
 - b. Specifically formulated for applications indicated, including wet areas.
 - c. Elastomeric.
 - d. Shore A Hardness: 25.
 - e. Compatible with laminate specified.
 - f. Compatible with Gypsum wallboard, Painting, Solid Surfacing and other materials being sealed.
 - g. Sealants shall have a VOC content of no greater than 250 g/L.
 - 2. Colors:
 - a. Colors as required to match Plastic Laminate, Stone, Wood, Solid Surfacing and other materials specified for casework bodies, countertops and splashes.
 - b. Architect to select from no less than 450 standard color choices.
 - c. Number of different colors required for project shall not be limited.
 - 3. Base Product(s):
 - a. Solid Colors: "Color-Sil" by Color Rite or equal; 100% Silicone, no suspended partials.

- b. Speckled Colors: "Poly-Sil" by Color Rite or equal; includes polymers suspended in 100% Silicone.
- c. Architect to select final colors and locations during submittals phase.

2.3 CABINET DOOR HARDWARE

- A. 5-knuckle (Institutional) Hinges:
 - 1. Institutional (hospital tip), 5 knuckle, wrap around type (screwed to back of door and side of divider/end), with barrel only projecting beyond face of cabinet.
 - 2. Usage: Use on all cabinets unless noted otherwise.
 - 3. Minimum Height: 2-3/4 IN.
 - 4. Minimum 8 screws per hinge.
 - 5. Shall pass ANSI/BHMA-A156.9 Grade-1 requirements.
 - 6. Hinge Quantities per leaf:
 - a. For doors up to 48 IN high: 2 hinges.
 - b. For doors over 48 IN high: 3 hinges.
 - 7. Finish: Epoxy Powder Coat, Architect to select color(s).
 - 8. Base Product: "370/450 Overlay Hinge Series" by Rockford Process Control (RPC) or equal.

AD-4:

- B. Pulls:
 - 1. Sugatsune America – Item # KPH-160
 - 2. 6.3 IN centers.
 - 3. Finish: 304Stainless steel, satin finish.
- C. Pulls at Conference A323:
 - 1. Hafele
 - a. At drawers:
 - 1) Item No. 100.45.051
 - b. At doors:
 - 1) Item No. 100.45.055
 - c. Alternate manufacturer:
 - 1) Frost Design – Ocean series, to match size/style/finish.
- D. Catches:
 - 1. Magnetic, adjustable, 6-7 LB pull; or Roller type; provide 40 LB unit on doors over 4 FT².
- E. Locks:
 - 1. Provide as noted on Q-Drawings.
- F. Elbow Catch:
 - 1. Provide at doors with locks.
- G. Door Stops:
 - 1. Metal slide type with positive stop.
- H. Door Bumpers:
 - 1. Provide on backside of all doors.

2.4 CABINET DRAWER HARDWARE

- A. Drawer Slides:
 - 1. Nylon wheels/rollers, stainless steel or polymer ball bearings, positive closing and pull out stops, drawer removable without use of tools; file drawers.
 - 2. Full extension (all capacities).
 - 3. Capacity:
 - a. Standard Drawers (other than types listed below): 100 LBS.
 - b. File Drawers: 150 LBS.
 - c. Lateral Files:

- 1) Less than 42 IN wide: 200 LBS.
- 2) 42 to 48 IN wide: 400 LBS.
4. Optional Product:
 - a. "Metabox System" by Blum, is acceptable where capacities (listed above) can be met.

AD-4:

- B. Pulls:
 1. Sugatsune America – Item # KPH-160
 2. 6.3 IN centers.
 3. Finish: 304 Stainless Steel, satin finish.
- C. Locks:
 1. Provide as noted on A-Drawings.
- D. Suspension Rails (file drawers):
 1. Description: 14 GA steel pendaflex file suspension rails, epoxy coated in dove gray, frosty white or light beige to match drawer body color.
 2. Provide one pair of such rails at file drawers.
- E. Drawer bumpers:
 1. Provide on backside of drawer faces.

2.5 LOCKS

- A. Locks (typical type):
 1. Small-pin tumbler with heavy-duty deadbolt.
 - a. Disc-tumbler type locks will not be accepted.
 - b. Cam locks will not be accepted.
 2. Keyway: D4292 (5-pin).
 3. ANSI/BHMA Standard: E07121.
 - a. Cycle Tested per ANSI/BHMA A156.11 Grade 1.
 4. Base Products:
 - a. Door Locks: "#100DR" by Olympus Lock or equal.
 - b. Drawer Locks: "#200DW" by Olympus Lock or equal.
 5. Finish: Satin Chrome US26D (BHMA 626).
 6. Include spacers, adapters, fasteners and strikes.
 7. Barrel Length: As appropriate for conditions.
 8. Provide 2 keys for each lock.
 9. Master key and grand master key as directed.
 10. Finish: As selected by Architect.
- B. Extra Material:
 1. Provide 20 extra locks of each type; door locks and drawer locks to Laboratory at closeout.

2.6 SUPPORTS AND BRACKETS

- A. Adjustable Shelf Supports (drilled hole type):
 1. Description: Friction fit into cabinet end panels and vertical dividers, readily adjustable on 1 1/4 IN centers.
 2. Material: Injection molded polycarbonate.
 3. Color: Clear to blend with selected interior finish.
 4. Provide non-tip feature and allow for field fixing of shelf if desired
 5. Capacity: Structural test shall indicate loading of shelf to 1500 LBS (375 LBS per support device).
 6. No substitutions.
- B. Wall Shelf Supports:
 1. Provide for shelves mounted to walls (not within cabinets).
 2. Finish: Enamel, Anochrome or anodized aluminum.
 3. Standards: Heavy duty slotted steel.

4. Shelf brackets: Boltless, steel or aluminum, shelf depths as indicated.
 5. Shelf rests: Anchor shelf to bracket.
- C. Metal Bracket for Cantilevered Countertop:
1. Material: 1/8 IN thick steel.
 2. Pre-drilled for attachment to wall and countertop.
 3. Include fasteners suitable for conditions.
 4. Coordinate locations of blocking (see Section 09 22 16).
 5. Capacity: 1000 LBS per bracket.
 6. Base Product: "2424 AMH" by Wizard Products or equal.
 7. Finish: Powder coat.
 8. Color: To be selected by Architect.

2.7 HARDWARE FOR REMOVABLE PANELS

- A. Catches (for removable panels):
1. "Flush Recessed Catch" by Bull Dog or equal.
 2. Provide 4 per panel.

2.8 GROMMETS

- A. Grommets for cords:
1. Base Product: "XG-3" by Doug Mockett & Company, Inc or equal.
 2. Finish: Black or putty as selected by Architect.
 3. Size: Provide 3-1/2 IN diameter flip top grommet cap with 7/8 IN x 1-3/8 IN cord slot.
 4. Provide as directed by Laboratory after installation of equipment at each location such as, but not limited to, undercounter electrical or systems outlet, cord drop location, and keyboard drawer location.

2.9 FABRICATION – ARCHITECTURAL CASEWORK

- A. Definitions:
1. Exposed surfaces: Surfaces visible when doors and drawers are closed:
 - a. Door and drawer fronts, and their edges.
 - b. Exposed ends.
 - c. Bottom of wall case.
 - d. Countertop and backsplash and their exposed edges.
 - e. Face of cabinet body not covered by doors or drawer fronts.
 - f. Toe strip not to be covered by separate base.
 - g. Wall mounted adjustable shelves and their edges.
 - h. Interior of open cabinets, including shelving.
 - i. Interior of cabinets with glass doors.
 2. Concealed surfaces: Surfaces not visible after installation:
 - a. Solid top panels.
 - b. Security panels.
 - c. Locking rails.
 3. Semi-exposed surfaces: All other surfaces including:
 - a. Interior of closed cabinets.
 - b. Top of wall and tall cases.
 - c. Drawers.
- B. Joinery
1. Case body:
 - a. Sides, dividers, bottom, and tops members: Dowel with 10mm fluted hardwood dowels. Provide minimum of 6 dowels at each joint for 24 IN deep cabinets and a minimum of 4 dowels for 12 IN deep cabinets.
 - 1) Glue joints.

- b. Back: Dado into sides, bottom, and top. Locate dado 3/4 IN in from back face of cabinet or on-set type, lead in at finished ends, screwed at the top and bottom, stapled at the sides.
 - 1) Glue joints.
 - c. Compartment dividers & lock rails: Doweled.
 - d. Base: Integral or separate, to receive base material to match adjacent walls, unless noted otherwise.
 - e. Blind-fasten to bottom of case body when separate.
2. Drawers with Sub-fronts:
- a. Sub-front, sides and back: Doweled corners: Glue joints.
 - b. Bottom: Dado into 4 sides and glued or screwed to the bottom with the use of bottom supporting drawer slide hardware.
 - c. Front: Secured from sub-front side with no less than four screws after adjustments.
 - d. Use no blocking or fasteners in exposed or Semi-exposed locations
- C. Case Components (for Plastic Laminate-faced Cabinets):
1. General Finishes for non-fire-rated cabinets:
- a. Exposed surfaces: Plastic Laminate.
 - b. Semi-exposed surfaces: Plastic Overlay.
 - c. Edges of Doors and Drawer Fronts: 3mm PVC edge banding.
 - d. Edges of Case Body members: 1mm PVC edge banding.
 - e. Edges of Shelves: 1mm PVC edge banding (4-sides).
2. Case Body Members:
- a. Sides: 3/4 IN Particleboard with Plastic Overlay (1-side).
 - b. Top Panels: 3/4 IN Particleboard with Plastic Overlay (2-sides).
 - c. Backs: 1/2 IN Particleboard with Plastic Overlay (1-side).
 - 1) Exception: Where back face is exposed to view: Upgrade to 3/4 IN Particleboard; Plastic Overlay on inside face; Plastic Laminate (color matching sides and fronts) on exposed back face.
 - d. Semi-exposed Members: 3/4 IN Particleboard with Plastic Overlay (2-sides).
 - e. Exposed edges of Particleboard: 1mm PVC edge banding.
 - f. Security Panels: 1/2 IN Particleboard with Plastic Overlay (2-sides).
 - g. Drawer Lock Rails: 3/4 IN Particleboard with Plastic Overlay (2-sides).
 - h. Base: 3/4 IN Plywood or Particleboard, with intermediate reinforcing at 24 IN on O.C. (maximum).
3. Shelves:
- a. Semi-exposed Shelves: 3/4 IN Particleboard with Plastic Overlay (2-sides).
 - 1) Exception: Increase thickness to 1 IN for spans exceeding 30 IN.
 - b. Exposed Shelves: Shelves: 3/4 IN Particleboard with Plastic Laminate (2-sides).
 - 1) Exception: Increase thickness 1 IN for spans exceeding 30 IN.
4. Doors:
- a. 3/4 IN Particleboard with Plastic Laminate on exposed faces, Plastic Overlay on semi-exposed faces.
 - b. Edges: 3mm PVC edge banding on laminate-faced doors.
 - c. Doors not to exceed 25 IN in width.
5. Drawers:
- a. Drawer Fronts:
 - 1) 3/4 IN Particleboard with Plastic Laminate on exposed faces, Plastic Overlay on semi-exposed faces.
 - 2) Edges: 3mm PVC edge banding on laminate-faced drawer fronts.
 - b. Sub-fronts, Sides and Backs:
 - 1) 1/2 IN Particleboard with Plastic Overlay (2-sides).
 - 2) Exposed top edges finished with 1mm PVC banding.
 - c. Bottoms:
 - 1) 1/2 IN Particleboard with Plastic Overlay (2-side).
 - 2) Include intermediate reinforcing rails where drawer width exceeds 18 IN.

6. Case Base: Integral or separate base for each unit.
 7. Small Compartment Dividers: 1/4 IN Clear acrylic panel.
 8. Filler Panels and Scribe Pieces: 3/4 IN Particleboard with Plastic Laminate exposed surfaces; Plastic Overlay on semi-exposed or fully concealed surfaces,
 9. Grain Direction (where laminate has a predominate grain direction): Vertical grain at all frames, cases, doors faces, drawer faces and all other vertical surfaces.
- D. Mechanical Fasteners:
1. Countertop joints:
 - a. Provide joint connectors every 6 IN OC.
 2. Pre-drill and countersink screw holes before installation.
 3. Do not use mechanical fasteners or blocking in exposed locations. When fasteners are required on exposed surfaces color, materials and finish to be approved by Architect.
- E. Case Configuration:
1. Plastic Laminate-Faced Units:
 - a. Provide reveal, approximately 1/8 IN, at top of doors and drawer fronts, and between doors and drawer fronts in same unit; reveal approximately 7/16 IN at sides.
 2. Toe space:
 - a. 4 IN high by approximately 3 IN deep; provide on front of each base unit unless noted on architectural drawings.
 3. Hardware mounting:
 - a. Drawers:
 - 1) Center pull in front, horizontally.
 - 2) No more than 4 IN from top.
 - b. Drawers with 2 pulls:
 - 1) Set pulls at 1/4 points.
 - 2) No more than 4 IN from top.
 - c. Swinging doors:
 - 1) Set pull in swing side corner, vertically; at top of base units; at bottom of wall units.
 4. Exposed adjustable shelves:
 - a. Use drilled hole supports only (32mm centers).
 5. Semi-exposed adjustable shelves:
 - a. Use drilled hole supports (32mm centers).
 - 1) Depth: 1/2 IN less than inside cabinet depth.
 - 2) Width: 1/8 IN, maximum, less than inside cabinet width.
 6. Provide doors at locations requiring access to electrical devices, as indicated on drawings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate Wall Backing has been installed.
 1. Metal Wall Backing: Specified in Section 09 22 16.
 2. Wood Backing (blocking): Specified in Section 06 10 53.
 3. Coordinate and direct installation of backing where required.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Manufacturer provide printed instructions or drawings indicating wall blocking locations and type required to Contractor in advance of casework installation. Coordinate with Contractor.

- B. Use manufacturer's printed instructions or drawings in cases where items or details are not indicated.
- C. Provide trim, fillers, closures, stands, supports, sleeves, collars, escutcheons, ferrules, brackets, braces or other miscellaneous items required for complete installation.
- D. Provide cutouts for mechanical and electrical items.
- E. Seal sink cutouts.
- F. Install up to 10 extra door locks and 10 extra drawer locks in casework not previously shown or scheduled to have locks.
 - 1. Install extra locks where directed by Laboratory.
 - 2. Closeout: Turn over any extra uninstalled locks to Laboratory.

3.3 SEALING OF JOINTS

- A. Seal casework, countertops and splashes to walls, to seal joints.
 - 1. Sealant color to match countertop color.
- B. Seal perimeter of counter-mounted sink fixtures.
 - 1. Sealant color to match countertop or sink color(s).

3.4 ADJUSTMENTS AND CLEANING

- A. Test and adjust items of equipment for satisfactory operation.
- B. Adjust hinges for proper door alignment.
- C. Adjust drawer guides for proper drawer front alignment and operation.
- D. Adjust countertops to a level position and align to adjacent unit.
- E. Repair damage to casework or countertops to appear in original new condition.
- F. Repair damage to premises as a result of installation.
- G. Remove debris left by this installation.
- H. Clean casework and countertops after above items have been completed.

END OF SECTION

SECTION 12 35 53
LABORATORY CASEWORK AND OTHER FURNISHINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal Laboratory Casework, Tables, and Casework Systems:
 - 1. Metal Laboratory Casework.
- B. Stainless Steel Laboratory Casework and Tables.
- C. Cabinet Hardware.
- D. Laboratory Work Surfaces.
- E. Mobile Base Cabinets.
- F. Shelving Assemblies
- G. Overhead Service Carriers.
- H. Drying Rack.
- I. Metal Fabrications and Finish Requirements.
- J. Stainless Steel Fabrications:
 - 1. Work Surfaces.
 - 2. Laboratory Sinks and Cup Sinks.
 - 3. Canopy Hoods.
- K. Slotted Channel Framing (Strut).
- L. Lab Coat Hooks
- M. Safety Glass Holder
- N. Soap Dispenser
- O. Paper Towel Dispenser
- P. Sealant.

1.2 UNDIVIDED RESPONSIBILITY

- A. Unless specified otherwise, because of special coordination requirements, the supplier of the scope of work described in this Section shall also provide the scope of work described in the following Sections:
 - 1. Section 11 53 00 - Laboratory Equipment.
 - 2. Section 11 53 13 - Fume Hoods and Exhaust Devices.
 - 3. Section 11 53 33 – Laser Safety Equipment.
 - 4. Section 11 53 43 - Laboratory Service Fittings and Fixtures.
 - 5. Section 13 21 14 - Controlled Environment Rooms.

1.3 REFERENCES

- A. Work shall conform to the recommended practices of the Scientific Equipment and Furniture Association (SEFA), current version, except as superseded by this specification:
 - 1. SEFA 2 - Installation.
 - 2. SEFA 3 - Work Surfaces.
 - 3. SEFA 7 - Fixtures.

4. SEFA 8 M – Laboratory Grade Metal Casework.
- B. American Woodwork Institute (AWI): Architectural Woodwork Quality Standards Illustrated, Eighth Edition, 2003.
 - C. American National Standards Institute:
 1. ANSI A208.1-1999 – Particleboard Plywood.
 2. ANSI A208.2-1999 – MDF Plywood.
 3. ANSI/HVPA HP-1 2004 – American National Standard for Hardwood and Decorative Plywood, with the Hardwood Veneer Plywood Association.
 - D. U. S. Green Building Council:
 1. New Construction & Major Renovation, LEED 2009.

1.4 CASEWORK DESIGN AND PERFORMANCE CRITERIA

- A. Dimensions: Cabinets may be manufacturer's standard depth, provided such standard is not more or less than 1 inch (25mm) of the depth indicated on the Drawings.
- B. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
 1. Wall Cabinets: 160 lb/lf (240kg/m).
 2. Work Surfaces: 160 lb/lf (240kg/m).
 3. Shelving: 40 lb/sf (200kg/m²); deflection limited to the length of the shelf in inches divided by 144.

1.5 SUBMITTALS

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for work in this section.
- C. 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 reproducibles or photocopies, not to exceed 11 IN by 17 IN in size. Blue line prints are not acceptable.
- D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements.
 1. Casework shall be designed and anchored in accordance with IBC 2000 Seismic Design Category C requirements.
- E. Samples: Accompanying Materials List, submit two (2) samples of each of the following items for Architect's approval:
 1. 4 IN by 4 IN sample of each laboratory work surface specified.
 2. 3 IN by 5 IN sample of each available standard paint color, stain with finish, or laminate, as is applicable.
 3. Hardware: pulls, locks, hinges, padlock latches, label holders, as specified.
 4. One (1) sample of each casework type specified, standing height or suspended height cabinet, respectively, 24 IN wide, with one drawer on top with door and adjustable shelf below.
- F. LEED Information:
 1. MR Credit 4.1 and Credit c4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 2. MR Credit 5.1 and Credit 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from

- Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. EQ Credit 4.1, Low-Emitting Materials, Adhesives: Manufacturers' product data for construction adhesive, including printed statement of VOC content.
 4. EQ Credit 4.2, Paints and Coatings: Manufacturers' product data indicating VOC content of specified products.
- G. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and Laboratory'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.
- H. Informational Submittals:
1. Statement of Installer Qualifications.
 2. Load Tests: Provide on request, load test results certified by an independent testing laboratory for cabinet box, drawers, doors, suspensions slides, and unit shelving as identified in SEFA 8.
 3. Certificates:
 - A. Certify that factory tests specified for mechanical service fixtures have been performed and that products or systems meet or exceed specified requirements.
 - B. As a condition of acceptance, submit certification stating that equipment is complete and ready for intended function.

1.6 PRODUCT HANDLING

- A. Contractor shall schedule the delivery of casework and furnishings when spaces are sufficiently complete so materials can be installed immediately following delivery.
- B. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades.
- C. 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 Laboratory.

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. Casework installers shall be approved in writing by the casework manufacturer for the installation of specified products.

PART 2 - PRODUCTS

2.1 METAL LABORATORY CASEWORK, TABLES AND CASEWORK SYSTEMS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All painted metal laboratory casework, tables, and casework systems shall be provided by a single manufacturer.
 1. Laboratory Casework:

- A. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241, Tel: 920 793-1121. website: <http://www.hamiltonlab.com/>
 - B. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687, Tel: 704 873-7202. website: <http://www.kewaunee.com/>
 - C. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728, Tel: 800 711-5227. website: <http://www.alc-corp.com>
 - D. Mott Manufacturing Limited, 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3, Tel: 519 752-7825. website: <http://www.mott.com/>
 - E. Substitutions are permitted subject to Section 01 63 00.
2. Corrosives and Flammable Liquid/Solvent Storage Cabinets:
- A. Manufacturers of metal laboratory casework.
 - B. Justrite Manufacturing Company, 2454 Dempster St., Suite 300, Des Plaines, IL 60016 Tel: 800 798-9250. website: <http://www.justritemfg.com/>
 - C. Eagle Manufacturing Company, 2400 Charles St., Wellsburg, WV 26070 Tel: 304 737-3171. website: <http://www.eagle-mfg.com/>
 - D. Substitutions are permitted subject to Section 01 63 00.
- B. Design Requirements:
- 1. Door and drawer front design: Full flush overlay, construction with metal door and drawer fronts overlaying the case unit ends, top and bottom rails. Provide applied panels in areas such as sink cabinets and knee spaces with apron panels to provide a full flush overlay appearance.
 - 2. Pulls on doors shall be mounted vertically and on drawers horizontally.
 - 3. All tall cases shall be provided with toe space to match base units.
 - 4. 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.
 - 5. Widths of drawers in knee opening rails shall not be less than 24 IN or the width of the rail whichever is the lesser.
 - 6. Structural Requirements: Work shall conform to the recommended structural requirements and testing of Scientific Equipment and Furniture Association, except as superseded by this specification.
- C. Materials:
- A. Cold rolled sheet steel:
 - A. Environmental Compliance:
 - 1. All steel used in the product fabrication shall comply with the LEED (Leadership in Energy and Environmental Design) Green Building Design and Construction, version 3, 2009 edition, MR Credit 4.
 - 2. The manufacturer shall submit documentation (i.e., "Source of Materials", Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled content. Such documentation shall be submitted to the Architect for approval - prior to award of contract.
 - B. Recycled Steel Content: A minimum of 20 percent of the steel used in the fabrication of laboratory cabinets and modular laboratory systems, if specified, shall consist of the sum of post-consumer recycled content plus one-half of the pre-consumer content, based on the cost of the total value of materials.
 - C. Fabricators Scrap: Fabricators shall provide documentation that manufacturing fall-off is recycled to respective steel mills and neither enters the solid waste system nor becomes a product of landfill space.
 - D. Prime grade, roller leveled, and treated at the mill to be free of scale, ragged edges, deep scratches or other injurious effects. Thickness of metal used in construction of cases shall be 18 gauge (1.3mm), except as follows:
 - 1. 20 gauge (1.0mm thick): Solid door interior panels, drawer fronts, scribe strips, filler panels, enclosures, drawer bodies, shelves, security panels, and sloping tops.

2. 16 gauge (1.6mm thick): Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
 3. 14 gauge (2.0mm thick): Drawer suspensions, door and case hinge reinforcements, and front corner reinforcements.
 4. 12 gauge (2.8mm): Table leg corner brackets and gussets for leveling screws.
2. Glass: Framed glass doors:
- A. 7/32 IN nominal laminated glass with 0.060 IN clear vinyl interlayer, ANSI Z97.1, ASTM C1036 or C1048.
 - B. Without imperfections or marred surfaces.
 - C. Cut or drill to receive hardware.
- D. Construction
1. General:
 - A. 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.
 - B. Exterior corners: shall be spot and arc welded with gussets at exterior corners. All face joints shall be arc welded and ground smooth to provide a continuous flat plane.
 - C. Units less than 49 IN tall: Provide internal reinforcing and rear posts for end panels and cabinet backs.
 - D. Units 49 IN tall and greater: Provide formed end panels with front and rear reinforcing posts. Back shall be formed steel panel, recessed 3/4 IN for mounting purposes.
 - E. Posts: Front post fully closed with full height reinforcing upright to facilitate cleaning.
 - F. Shelf adjustment posts shall be perfectly aligned for level setting, with holes for shelf adjustment at 1/2 IN on center.
 - G. The front edge shall be formed to provide a strike for doors and drawers, and shall be pre-drilled for intermediate rails and hinge screws.
 - H. Intermediate Vertical Uprights: shall be furnished to enclose cabinets 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.
 - I. The inside front of the upright shall be further reinforced with a full height 14 gauge hinge reinforcement angle.
 - J. Wall and Tall Case Top: One-piece, with front edge formed into front rail.
 - K. 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. When wall hung cabinets are installed to ceiling, provide continuous metal filler between top of cabinet and ceiling, to permit door to swing clear of ceiling. Maximum filler panel width is 1-1/2 IN, and should be balanced on each end of wall-to-wall elevations.
 - L. Exposed fasteners are not allowed without prior approval of the Architect.
 2. Base, Wall, Upper, and Tall Cabinets:
 - A. 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 rabbeted in front for drawers and swinging doors.
 2. Toe Space Rail: Provide 3 IN deep and 4 IN high formed steel base with corner gussets. Whenever the base is omitted for units to be set on building bases or separate metal bases, the toe space rail shall extend back 4-1/2 IN. Provide 3/8 IN diameter leveling screw with integral bottom flange of minimum 0.56 in² area at each corner, accessible through openings in toe space.

- B. Removable 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.
 - C. Knee Space Service Chase Cover Panels where specified, shall be 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.
 - D. Shelves: shall be full depth formed down 3/4 IN, back 7/8 IN and up 1/4 IN at front and rear and formed down at ends 3/4 IN. Shelves over 36 IN in length shall be additionally reinforced by a flanged channel shaped member electro-welded to underside of shelf. Shelves shall be adjustable.
 - E. Pull-Out Shelves: Provide pull-out shelves in cabinet or locations indicated.
 - F. Doors and Drawer Heads (Flush Overlay Steel):
 - 1. Doors: 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.
 - 2. Door and Drawer Heads (metal): shall be a two-piece sheet steel assembly of 3/4 IN overall thickness to consist of an inner pan, 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 sound deadening at the time of assembly. Welds shall be ground smooth. Door Pans and Drawer Heads shall be painted inside and out prior to assembly.
 - 3. Framed Glazed Doors: Framed glazed door construction shall match construction and quality of solid panel doors. Inner head shall include top, bottom, and side framing members which are removable for installation and replacement of glass. Continuous vinyl retainer shall be provided to receive glass.
 - G. Drawer Construction:
 - 1. Drawer bodies shall be made in one-piece construction including the bottom, two sides, back and inner front, or one piece center section with bottom and coved sides, with formed top edges. Front and back faces should be spot welded to sides or center section. Sides shall be full height with 1/2 IN clearance to frame opening. Drawers shall be a minimum of 18 IN front to back. Drawers shall be easily removable in the field without the use of special tools. Drawers shall be sized on a modular basis for interchange to satisfy varying storage requirements.
 - 2. Drawer Suspension: Refer to Drawer Slides under Hardware section.
 - 3. Drawer stops: Rubber bumpers shall be provided to insure smooth, quiet operation at point of contact with cabinet front.
 - H. Rails:
 - 1. 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.
 - 2. 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.
3. Metal-Framed Laboratory Tables and Mobile Instrument Carts
- A. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.
 - B. Casters: Where indicated on Laboratory Furnishing drawings or specifications, as specified under Cabinet Hardware. Supply with interchangeable floor levelers.
 - C. Table Drawers: Where indicated on the drawings, provide front and back rails; drawer unit, hardware and suspension same as specified for casework base unit drawers.

- D. Aprons and Rails: Not less than 1-1/2 IN by 4-1/2 IN 16 gauge channel steel sections, reinforced as necessary for leg attachment. Provide 1-1/2 IN by 2 IN 16 gauge channel steel sections, reinforced as necessary for leg attachment, where no drawers are required.
 - E. Legs: Not less than 2 IN by 2 IN 16 gauge square tubular steel sections with welded leg brackets.
 - 1. Table legs shall be telescoping to allow vertical height adjustment of work surface in 1 IN increments from 30 IN to 37 IN above finished floor.
 - F. Leg rails and spreader rail: Not less than 1-1/4 IN by 2-1/2 IN 16 gauge steel sections, reinforced as necessary for leg attachment.
 - G. Vertical uprights: 16 gauge (1.6mm) steel to accommodate overhead storage where shown on drawings.
 - H. Low level shelf: If shown on Laboratory Furnishing drawings shall be of 20 gauge (1.0mm thick) steel sheet with perimeters formed down 3/4 inch (19mm) and reinforced by a flanged channel shaped member electro-welded to underside of shelf.
4. Leg assemblies:
 - A. Legs: Not less than 2 IN by 2 IN by 16 gauge square tubular steel sections. Each leg shall have a recessed leveling screw and a black, coved vinyl or rubber leg shoe, 2 IN in height.
 - B. Leg rails, where required: Not less than 1-1/4 IN by 2-1/2 IN by 16 gauge steel sections, reinforced as necessary for leg attachment.
 5. Apron: Not less than 1-1/2 IN by 4-1/2 IN 16 gauge channel steel sections, reinforced as necessary for leg or panel attachment. Provide 1-1/2 IN by 2 IN 16 gauge channel steel sections, reinforced as necessary for leg attachment, below work surfaces set at 32 IN above finished floor, or less. Apron panel shall align with plane of adjacent doors and drawers for full flush overlay appearance.
 6. Apron drawers: Where indicated on the Laboratory Furnishing drawings, provide support rails; drawer unit, hardware and suspension as specified for base unit drawers. Widths of drawers in knee opening rails shall not be less than 24 IN or the width of the rail whichever is the lesser.
 - A. Width of drawer heads shall match width of knee opening in flush overlay applications
 7. Fume Hood Cabinets: Purpose-designed metal cabinet with fixed panel above door to conceal cup sink and plumbing.
 8. Corrosives Storage Cabinets:
 - A. Purpose-designed metal cabinet completely lined with a polypropylene liner with sealed or seamless intersections between panels. Cabinet may be manufacturer's inset steel design.
 - B. Shelf: Removable, polypropylene 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.
 - D. Locks: Provide key locks for cabinet doors.
 - E. Venting:
 1. Cabinets below or adjacent to fume hoods: Provide and install 2 IN polypropylene vent pipe to extend 4 IN above dished worktop, behind baffle in hood. Seal gap around penetration with clear sealant.
 2. Cabinets not below or adjacent to fume hoods: Provide and install 2 IN polypropylene vent pipe to run horizontally in the chase space behind the casework to nearest pipe drop enclosure and rise vertically to 6 IN above ceiling level. Connection to exhaust duct system shall be by Division 23.
 - F. Provide hole through fume hood work surface above the corrosives storage cabinet to accommodate 2 IN diameter vent pipe.
 9. Flammable Liquid/Solvent Storage Cabinets:
 - A. Purpose-designed double-walled metal cabinet for the storage of flammable, combustible and solvent liquids. Cabinet may be manufacturer's inset steel design.

- B. Cabinet doors: Well fitting, self-closing and self-latching
 - 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 Corrosives Storage Cabinet label.
 - D. Locks: Provide key locks for cabinet doors.
 - E. Floor pan: Provide a 2 IN deep liquid tight pan to cover the entire bottom of the cabinet to contain liquid leaks and spills.
 - F. Shelves: Provide heavy-duty shelf (shelves) with reinforced edges and underside.
 - G. Casters: Provide cabinets with locking casters where indicated on the Laboratory Furnishing drawings or specifications and as specified under Cabinet Hardware.
 - H. Standards:
 - 1. Cabinet shall be in compliance with the requirements of:
 - A. OSHA: 29 CFR 1910.106
 - B. NFPA 1 (latest edition): Uniform Fire Code.
 - C. NFPA 30 (latest edition): Flammable and Combustible Liquids Code.
 - 2. Cabinets shall be Factory Mutual (FM) Approved or Underwriters Laboratories (UL) Listed.
 - I. Flammable liquid/solvent storage cabinets shall not be vented. Seal vent openings with bungs as provided by manufacturer.
 - J. 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.
10. Vacuum Pump Cabinets:
- A. Purpose-designed metal cabinet with interior top, sides, rear, and door lined with sound absorbing material.
 - 1. Cabinet shall have no bottom, and shall have specially fabricated door to extend to 1/8 IN above floor with integral toe kick to match the profile of the toe kick of adjacent cabinets. Provide louvers in toe kick to allow for airflow; openings shall continue through soundproofing material. Door shall swing open 165 degrees.
 - 2. Provide separate mobile platform or trolley capable of supporting 300 lbs. Platform shall be 1/2 IN solid phenolic (Trespa Athlon, Pionite Thick Phenolic Core, or approved substitution) with 1/2 IN by 1 IN high shelf edge to contain spills. Platform shall be mounted on casters; the front casters shall be locking swivel type. Platform shall be 3 IN less than the exterior width of the cabinet and 18 IN in depth.
 - 3. Sound Absorbing Material: Closed-cell soundproofing foam.
 - A. Thickness: 1 IN flat sheet.
 - B. Insulating mat shall be fire retardant, mold resistant, and designed to block and absorb sound. Material shall be HCFC- and CFC-free.
 - C. Color: Black.
 - B. Electrical: Provide NEMA 5-20R receptacle mounted to inside back of cabinet and activated by a remote pilot light toggle switch with stainless cover plate mounted on front blank panel of cabinet. Switch shall be hard wired to receptacle. Power to cabinet shall be provided under Electrical scope of work.
 - C. Venting: Cabinets below or adjacent to fume hoods:
 - 1. Provide and install 2 IN polyolefin or polypropylene vent pipe to extend 2 IN above dished worktop, behind baffle in hood. Seal gap around penetration with clear sealant. In cabinet, pipe shall terminate with open end. Also within cabinet, pipe shall have a 1 IN 'tee' for connection pump discharge connection by Laboratory and a drip leg with threaded cap. Provide flange to secure pipe to cabinet.

- D. Venting: Cabinets not below or adjacent to fume hoods and exhausted to fume exhaust system:
 - 1. Provide and install 2 IN polyolefin or polypropylene vent pipe through rear of cabinet for connection under the scope of work of Division 23. In cabinet, pipe shall terminate with open end. Also within cabinet, pipe shall have a 1 IN 'tee' for connection pump discharge connection by Laboratory and a drip leg with threaded cap. Provide flange to secure pipe to cabinet.
- E. Top of cabinet and work surface shall be drilled and furnished with a 1-1/2 inch (38mm) diameter black polyolefin or polypropylene sleeve from work surface into cabinet for vacuum hoses, connecting Owner-furnished vacuum pump to Owner-furnished equipment. Hoses shall be provided by Owner. Provide flange to secure pipe in work surface and bushing to terminate piping.
- 11. Hardware: As specified elsewhere in this Section.
- 12. Metal Casework Finish Requirements: Refer to Painted Metal Finish Performance Requirements elsewhere in this Section

2.2 STAINLESS STEEL LABORATORY CASEWORK AND TABLES

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All stainless steel laboratory casework and tables shall be provided by a single manufacturer.
 - 1. Laboratory Casework:
 - A. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241, Tel: 920 793-1121, website: <http://www.hamiltonlab.com/>
 - B. Mott Manufacturing Limited. 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3, Tel: 519 752-7825, website: <http://www.mott.com/>
 - C. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687, Tel: 704 873-7202, website: <http://www.kewaunee.com/>
 - D. Advanced Lab Concepts, P.O. Box 159, Round Rock, TX 78680, Tel: 512 246-8800, website: <http://www.alc-collegedale.com>
 - E. Substitutions are permitted subject to Section 01 63 00.
- B. Design Requirements:
 - 1. Door and drawer front design: Square edged, inset door and drawer flush front construction with all front surfaces above the toe space in the same plane. Front width of end panels shall be 3/4 inch (19mm) and front height of top and bottom members shall be 1 inch (25mm).
 - 2. Pulls on doors shall be mounted vertically and on drawers horizontally.
 - 3. All tall cases shall be provided with toe space to match base units.
 - 4. 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.
 - 5. Widths of drawers in knee opening rails shall not be less than 24 inches (610mm) or the width of the rail whichever is the lesser.
 - 6. Structural Requirements: Work shall conform to the recommended structural requirements and testing of Scientific Equipment and Furniture Association, except as superseded by this specification.
- C. Materials:
 - 1. In general, all materials shall be the best of their respective kinds for the intended purpose.
 - 2. Recycled Steel Content: A minimum of 20 percent of the stainless steel used in the fabrication of laboratory cabinets shall consist of the sum of post-consumer recycled content plus one-half of the pre-consumer content, based on the cost of the total value of materials.
 - 3. Stainless sheet steel: Type 304, with exposed surfaces ground and polished to a No. 4 satin finish.
 - 4. Minimum sheet metal thickness: 18 gauge (1.3mm), except as follows:

- A. 20 gauge (1.0mm thick): Solid door interior panels, drawer fronts, scribe strips, filler panels, enclosures, drawer bodies, shelves, security panels, and sloping tops.
 - B. 16 gauge (1.6mm thick): Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
 - C. 14 gauge (2.0mm thick): Drawer suspensions, door and case hinge reinforcements, and front corner reinforcements.
 - D. 12 gauge (2.8mm): Table leg corner brackets and gussets for leveling screws.
- D. Construction:
- 1. General:
 - A. 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.
 - B. Exterior corners: shall be spot and arc welded with gussets at exterior corners. All face joints shall be arc welded and ground smooth to provide a continuous flat plane.
 - C. Units less than 49 inches (1245mm) tall: Provide internal reinforcing and rear posts for end panels and cabinet backs.
 - D. Units 49 inches (1245mm) tall and greater: Provide formed end panels with front and rear reinforcing posts. Back shall be formed steel panel, recessed 3/4 inch for mounting purposes.
 - E. Posts: Front post fully closed with full height reinforcing upright to facilitate cleaning.
 - F. Shelf adjustment posts shall be perfectly aligned for level setting, with holes for shelf adjustment at 1/2 inch (12.7mm) on center.
 - G. The front edge shall be formed to provide a strike for doors and drawers, and shall be pre-drilled for intermediate rails and hinge screws.
 - H. Intermediate Vertical Uprights: shall be furnished to enclose cabinets 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.
 - I. End Uprights shall be formed into not less than a channel formation at top, bottom, back and front.
 - J. 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.
 - K. The upright filler shall be perforated with shelf adjustment holes at no more than 1/2 inch (12.7mm) centers.
 - L. The inside front of the upright shall be further reinforced with a full height 14 gauge (2.0mm thick) hinge reinforcement angle.
 - M. Wall and Tall Case Top: One-piece, with front edge formed into front rail. Provide sloping tops when indicated on the Drawings.
 - N. 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. When wall hung cabinets are installed to ceiling, provide continuous metal filler between top of cabinet and ceiling, to permit door to swing clear of ceiling.
 - O. Exposed fasteners are not allowed without prior approval of the Architect.
 - 2. Base, Wall, Upper, and Tall Cabinets:
 - A. 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 rabbeted in front for drawers and swinging doors.
 - 2. Toe Space Rail: Provide 3 inches (76mm) deep and 4 inches (102mm) high formed steel base with corner gussets. Whenever the base is omitted for units to be set on building bases or separate metal bases, the toe space rail shall extend

- back 4-1/2 inches (115mm). Provide 3/8 inch (9.5mm) diameter leveling screw with integral bottom flange of minimum 0.56 in² (3.6 cm²) area at each corner, accessible through openings in toe space.
- B. Removable 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.
 - C. Knee Space Service Strip Cover Panels where specified, shall be 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.
 - D. Shelves: shall be full depth formed down 3/4 inch (19mm), back 7/8 inch (22mm) and up 1/4 inch (6mm) at front and rear and formed down at ends 3/4 inch (19mm). Shelves over 36 inches (914mm) in length shall be additionally reinforced by a flanged channel shaped member electro-welded to underside of shelf. Shelves shall be adjustable.
 - E. Doors and Drawer Heads:
 - 1. Doors: 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.
 - 2. Door and Drawer Heads (metal): shall be a two-piece sheet steel assembly of 3/4 inch (19mm) 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. Welds shall be ground smooth. Door Pans and Drawer Heads shall be painted inside and out prior to assembly.
 - 3. Framed Glazed Doors: Framed glazed door construction shall match construction and quality of solid panel doors. Inner head shall include top, bottom, and side framing members which are removable for installation and replacement of glass. Continuous vinyl retainer shall be provided to receive glass.
 - F. 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 1/2 inch (13mm) clearance to frame opening. Drawers shall be a minimum of 18 inches front to back.
 - 2. Drawer stops shall be provided to insure smooth, quiet operation at point of contact with cabinet front.
 - G. Rails:
 - 1. Top Horizontal Rail: Provide on base units 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.
 - 2. Intermediate Rails: Provide such that rail 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.
3. Stainless Steel-Framed Laboratory Tables
- A. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.

- B. Casters: Where indicated on Laboratory Furnishing drawings or specifications, as specified under Cabinet Hardware.
 - C. Table Drawers: Where indicated on the drawings, provide front and back rails; drawer unit, hardware and suspension same as specified for casework base unit drawers.
 - D. Aprons and Rails: Not less than 1-1/2 inch by 4-1/2 inch 16 gauge (38mm x 114mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg attachment. Provide 1-1/2 inch by 2 inch 16 gauge (38mm x 52mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg attachment, where no drawers are required.
 - E. Legs: Not less than 2 inch by 2 inch 16 gauge (50mm x 50mm x 1.6mm) square tubular stainless steel sections with welded leg brackets.
 - 1. Table legs shall be telescoping to allow vertical height adjustment of work surface from 30 inches to 36 inches (762mm to 914mm) above finished floor.
 - F. Leg rails and spreader rail: Not less than 1-1/4 inch by 2-1/2 inch 16 gauge (32mm x 63mm x 1.6mm) steel sections, reinforced as necessary for leg attachment.
 - G. Low level shelf: If shown on Laboratory Furnishing drawings shall be of 20 gauge (1.0mm thick) stainless steel sheet with perimeters formed
- 4. Apron: Not less than 1-1/2 inch by 4-1/2 inch by 16 gauge (38mm x 114mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg or panel attachment. Provide 1-1/2 inch by 2 inch by 16 gauge (38mm x 52mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg attachment, below work surfaces set at 32 inches (819mm) above finished floor, or less.
 - 5. Apron drawers: Where indicated on the Laboratory Furnishing drawings, provide support rails; drawer unit, hardware and suspension as specified for base unit drawers. Widths of drawers in knee opening rails shall not be less than 24 inches (600mm) or the width of the rail whichever is the lesser.
- E. Hardware: As specified elsewhere in this Section.
 - F. Finish: All stainless steel casework shall be completely finished inside and out, whether exposed to view or not, to an even, consistent brushed satin (No. 4) appearance. All welds shall be made without discoloration and shall be ground, polished and passivated to match the surrounding surfaces.

2.3 CABINET HARDWARE

- A. General: Special metal cabinets, such as corrosives storage, flammable liquid and solvent storage, rock storage, map storage, museum storage, radioisotope storage, and narcotics locker, may be provided with the manufacturer's standard hardware, except that all door and drawer pulls shall match, regardless of type of casework, except for polypropylene casework.
- B. Hinges:
 - 1. Five Knuckle Hinges, Stainless Steel:
 - A. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - 1. Rockford Process Control, Inc. 202 Seventh St., Rockford, IL 61104, Tel: 815 966-2000.
 - 2. Substitutions are permitted subject to Section 01 63 00.
 - 2. Concealed Hinges:
 - A. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - 1. Grass America Inc., P. O. Box 1019, 1202 Highway 66 South, Kernersville, NC 27284, Tel: 800 334-3512.
 - 2. Julius Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164, Tel: 800 438-6788.
 - 3. Salice America Inc., 2123 Crown Centre Dr., Charlotte, NC 28227, Tel: 800 222-9652.

4. Substitutions are permitted subject to Section 01 63 00.
 3. General: Hinges shall be attached to both door and case with three screws through each leaf. Provide two hinges for doors up to 48 IN high; three hinges for doors over 48 IN high.
 4. Type: Concealed, self-closing, 165° opening Grass 3903 attached with sheet metal screws. Notch for proper fit.
 5. Type: Institutional with a five-knuckle bullet-type barrel. Characteristics:
 - A. Height: 2-1/2 IN, nominal.
 - B. Material:
 1. Type 302 or 304 stainless steel with stainless steel screws.
- C. Shelving Standards and Clips:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - A. Knappe & Vogt Manufacturing Co., 2700 Oak Industrial Dr. NE, Grand Rapids, MI 49505, Tel: 616 459-7620.
 - B. Fixture Hardware Manufacturing, 4116 First Avenue, Brooklyn, NY 11232, Tel: 718 499-9422.
 - C. The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
 - D. Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746, Tel: 310 329-6373.
 - E. Bainbridge Manufacturing, Inc., P. O. Box 487, 237 W 3rd, Waterville, WA 98858, Tel: 800 255-4702.
 - F. Substitutions are permitted subject to Section 01 63 00.
 2. Adjustable shelf supports: 13 gauge steel angle with 5mm diameter by 3/8 IN long pin, bright zinc-plated finish, and all edges rounded, with slotted standard.
- D. Ball Bearing Drawer Slides:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - A. Accuride, 12311 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 562 903-0200. website: www accuride.com/
 - B. Waterloo Furniture Components Inc., 501 Manitou Dr., Kitchener, Ontario, Canada N2C 1L2, Tel: 519 748-5060.
 - C. Fulterer USA, 542 Townsend Ave., High Point, NC 27263, Tel: 800 395-4646.
 - D. Substitutions are permitted subject to Section 01 63 00.
 2. Typical Drawers: Full extension, 100 lb/pr. (45kg/pr.) capacity, minimum:
 - A. For drawer widths up to 18 inches (457mm): Accuride 4033, or equal.
 - B. For drawer widths greater than 18 inches (457mm) and up to 27 inches (686mm): Accuride 4032, or equal.
 - C. For drawer widths greater than 27 inches (686mm) and up to 42 inches (1067mm): Accuride 9301, or equal.
 3. File drawer cabinets shall be equipped with interlock, rail and pocket mount, and overtravel, 180 lb/pr. (81 kg/pr.) capacity: Accuride 3641, or equal.
 4. Pull-out shelf suspension: 100 lb/pr. (45kg/pr.) capacity pull-out shelf slide: Accuride 322, or equal.
 5. Base Metal:
 - A. Clear, zinc-coated steel.
- E. Hanging File Suspension System:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - A. Julius Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164, Tel: 800 438-6788.
 - B. Hettich America L. P., 6225 Shiloh Rd., Alparetta, GA 30005, Tel: 800 438-8424.
 - C. Substitutions are permitted subject to Section 01 63 00.

2. Blum Metafile, Hettich MultiTech Hanging File Frame Kit, or equal. File hangers shall be fastened and secured to drawer construction and shall not be freestanding units set inside the drawer. Provide in all file drawers.
- F. Locks:
1. Swinging Doors and Drawers:
 - A. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 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. Substitutions are permitted subject to Section 01 63 00.
 2. General: Provide locks on all file cabinet drawers. Provide locks at other locations as indicated on the drawings. Provide chain bolts 3 IN long, with an 18 IN pull and an angle strike to secure inactive door on cabinets over 72 IN in height. Five (5) or eight (8) tumbler locks are acceptable. Locks shall have be provided with removable cores and stamped with identifying numbers. Locks shall have satin nickel or satin chrome finish.
 3. Keys: Stamped brass keys available from manufacturer or locksmith and supplied in the following quantities, unless otherwise specified:
 - A. Provide two (2) keys for each different lock.
 - B. Provide three (3) keys for each group keyed alike locks.
 - C. Provide two (2) keys for each master key system.
 4. Keying:
 - A. Keyed differently with up to 2000 primary key changes. Master key one level with built in flexibility to accommodate, if required, three levels, one grandmaster, 59 master groups, and 70 sub-master groups with 13 primary changes under each.
- G. Roller Catch:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - A. The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
 - B. Amerock, 6350 Stevens Forest Road, Suite 200, Columbia, MD 21046, Tel: 800 435 6959.
 - C. Ives, 2720 Tobey Drive, Indianapolis, IN 46219, Tel: 877 613-8766.
 - D. Substitutions are permitted subject to Section 01 63 00.
 2. Roller Catches: Roller catches shall be adjustable, spring-loaded dual polyethylene roller with a steel strike plate. Double doors without locks shall have a catch on each door. Tall cabinets shall have roller catches located on the upper and lower part of each door. On cabinets equipped with locks, the left hand door shall have a positive catch and the right hand door shall have a roller catch.
- H. Levelers:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - A. Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164, Tel: 800 438-6788.
 - B. Camar, distributed by Peter Meier Inc., 1255 South Park Drive, Kernersville, NC 27284, Tel: 336 996-7774.
 - C. Häfele America Co., 3901 Cheyenne Drive, Archdale, NC 27263, Tel: 800 423-3531.
 - D. Hettich America LLP, 6225 Shiloh Road, Alpharetta, GA 30005 Tel: 770 887-3733.
 - E. Substitutions are permitted subject to Section 01 63 00.
 2. Provide levelers consisting of sockets and levelers rated at 330 lbs (150kg), minimum capacity. Provide a minimum of four levelers per cabinet. Levelers shall be accessible

through a hole in bottom of cabinet. Provide plastic cap for each leveler hole. Provide clip or other hardware for attachment of toe kick.

I. Casters:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
 - A. Algood Casters Limited, 605 Fenmar Drive, Toronto, Canada, M9L 2R6, Tel: 800 254-6633
 - B. Caster Technology Corporation, 3265 Whipple Rd., Union City, CA 94587, Tel: 510 429-6727.
 - C. Acorn Industrial Products Co., 7 Union Hill Dr., W. Conshohocken, PA 19428, Tel: 800 523-5474.
 - D. Hamilton Caster & Mfg. Co., 1637 Dixie Highway, Hamilton, OH 45011, Tel: 888 699-7164.
 - E. Substitutions are permitted subject to Section 01 63 00.
2. Where indicated on Laboratory Furnishing drawings or specifications, provide sets of 4 inch (102mm) diameter wheels with self-lubricating precision roller- or ball-bearings, rated to carry 200 pounds (90kg) minimum each. Each caster must swivel and have a total locking brake, unless specified otherwise. Wheel shall be of solid polyurethane or molded polyurethane tread mechanically locked to a polyolefin core.
 - A. Caster Housing – Metal casework: Casters shall be heavy gauge cold rolled steel with bright zinc plating.
 - B. Caster Housing Stainless steel casework: Casters shall be Type 304 stainless steel.

J. Pulls:

1. Drawer and hinged door: Drawer and door pulls shall attach to door or drawer with machine screws. Two (2) pulls shall be furnished on drawers wider than 28 IN. Plastic pulls or other types subject to breakage are not acceptable.
 - A. Type:
 1. Pulls shall be round “wire.”
 - B. Material and Finish:
 1. Stainless steel with US32D satin finish.
 - C. Length: 4 IN center to center of screw holes.
 - D. Diameter: 1/4 IN.

K. Drawer Stops: All regular drawers shall be equipped with integral stops or drawer bumpers on each side of drawer body to prevent drawer head impact with cabinet body.

L. Cabinet Door Bumper Pads: Non-staining, non-marring, clear polyurethane pads with pressure-sensitive, adhesive backing for sound and vibration dampening, preventing direct contact between door and cabinet. Pad should have raised tip in middle of pad. Provide at top and bottom corners along pull edge of doors 36 IN and less in height. Provide at top and bottom corners and at an intermediate location along pull edge of doors greater than 36 IN in height.

M. Door Stops: Provide chain door stops for any tall cabinet door, which will strike an obstruction when opened between 90° and 135°.

1. Provide #30 zinc-plated steel sash chains; cut to length to allow door to open 1-1/2 IN from obstruction.
2. Provide zinc chromate wire screw eyes. Open eye as required to attach chain. Through-bolting not allowed.

N. Leveling devices: Provide each table leg with 3/8 IN minimum diameter leveling bolt and floor clip.

O. 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 2-1/2 IN high and of black rubber or pliable black vinyl material. Use of a leg shoe which does not conceal leveling device is not acceptable.

- P. Floor clips: Provide leg assemblies and fixed table legs with floor clips securely fastened to the floor after shimming.

2.4 LABORATORY WORK SURFACES

A. Epoxy Resin:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All epoxy resin work surfaces shall be provided by a single manufacturer.
 - A. Durcon Inc., 206 Alison Drive, Taylor, TX 76574, Tel: 512 595-8000. website: <http://www.dltinc.com>
 - B. Epoxyn Products, 500 E. 16th Street, Mountain Home, AR 72653, Tel: 870 425-4321. website: <http://www.epoxyn.com/>
 - C. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687, Tel: 704 873-7202. website: <http://www.kewaunee.com/>

A. Substitutions are permitted subject to Section 01 63 00.

2. Thickness:

- A. Typical work surface: 1 IN.
- B. Window Sill: ¾" (location as shown on Laboratory Furnishings Drawings).
- C. Fume hood work surfaces: Tops shall be 1-1/4 IN thick at outer edge, indented 1/4 IN to provide a raised rim around all exposed edges 1 IN 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 IN radius. The juncture between the raised rim and the top surface shall be coved or chamfered to a 1/4 IN radius.

3. Color:

- A. Color sample shall be submitted for approval by Architect.

4. Provide the following:

- A. Drip Grooves: Provide under all work surface exposed edges, unless noted otherwise on the Laboratory Furnishing Drawings. Drip grooves shall be 1/2 IN from the front edge where the top overhangs 1 IN and 1/4 IN from the edge where the edge overhangs 1/2 IN.
- B. Edge profile: All exposed upper edges and corners shall have 1/8 IN bevel.
- C. Marine edges: Where indicated on the Laboratory Furnishing Drawings and at all sinks with dimensions to match size of sink base cabinet, shall be 1 IN wide and 1/4 IN high with chamfered or radiused transition to and be an integral part of the work surface.
- D. Indented areas: Where indicated on the Laboratory Furnishing Drawings, shall be 1/4 IN deep with chamfered or radiused sides. Internal and external corners shall have 1/4 IN to 1/2 IN radius. Marine edges formed around indented areas shall not be less than 1 IN wide.

E. Sink Mounting:

1. Under-mounted Sink Cutouts: Cutouts shall be smooth and uniform without saw marks with a uniform radius of approximately 1/8 inch (3mm) on the top edge conforming to the sink shape. The bottom edge of sink openings shall be finished smooth.

F. Curbs and Splashes:

1. Curbs and Splashes: 1 IN thick.
2. Height: 4 IN, unless noted otherwise on Laboratory Furnishing Drawings.
3. Bonded to the surface of the top to form a square joint.

- G. 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 IN. After sawing, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a waterproofing material recommended by the manufacturer.

H. Grommets:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.

- A. Doug Mockett & Company, Inc., Box 3333, Manhattan Beach, CA 90266, Tel: 800 523-1269.
 - B. Häfele America Inc., 3901 Cheyenne Dr., P. O. Box 4000, Archdale, NC 27263, Tel: 336 889-2322.
 - C. Substitutions are permitted subject to Section 01630.
2. Provide 2-3/8 inch (60 mm) O.D. plastic grommets, Doug Mockett and Co., Inc. Model No. TG-3, or equal, complete with removable slotted plastic cover. Color to be selected by Architect. Refer to plans for location.

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 IN 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

Test chemical	Concentration	Black	Dark gray	Light gray	Beige
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 IN Bunsen burner is adjusted to a quiet flame with a 1-1/2 IN 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
Tensile strength	ASTM D638	8,000 psi
Flexural strength	ASTM D790	11,700 psi
Rockwell hardness "M"	ASTM D785	122
Specific density	ASTM D792	122.4 lb/ft ³
Water absorption	ASTM D570	0.01%
Fire Resistance	ASTM D635	ATB (sec)=0
Heat deflection @ 264 psi	ASTM D648	342°F

D. Stainless Steel: Refer to Stainless Steel Fabrications section of this specification.

2.5 MOBILE BASE CABINETS

- A. Mobile Base Cabinets: Cabinets with casters shall be constructed without toe spaces. The cabinet shall be constructed with a reinforced base capable of supporting a 4" high caster assembly in each corner. Casters shall be swivel locking type and rated for minimum 250 pounds load each. Cabinets with casters shall be completely finished on four sides and top since surfaces are considered visible.

- B. The entire cabinet assembly shall be reinforced to permit mobility without twisting. Mobile cabinet heights to be coordinated with clearance height underneath mobile tables. Top of the base cabinet shall be chemical resistant laminate.
- C. Base cabinets shall, except as noted, incorporate a flush overlay design in which the cabinet body is completely concealed.
- D. Drawer units must be equipped with an anti-tip/anti-trick mechanism that shall include an interlock in the lower cabinet so that only one drawer in a vertical stack can be opened at one time. Base cabinets shall have a finished 12 gauge metal plate across the full bottom face of the cabinet to which casters shall be attached.

2.6 SHELVING ASSEMBLIES

- A. Provide 18 gauge steel shelves with integral seismic lip and hat-section stiffener with 16 gauge bookend brackets. Rear of bracket shall be profiled to fit into slots of shelf standards as described below. Refer to details on Laboratory Furnishings Drawings.
- B. Adjustable Wall Shelves:
 - 1. Shelving: Steel and stainless steel shelving as specified above.
 - 2. Double Slot Shelf Standards:
 - A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All adjustable shelf standards shall be the product of a single manufacturer.
 - 1. Knappe & Vogt Manufacturing Co., 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505 Tel: 616 459-3311. website: <http://www.knappeandvogt.com/>
 - 2. Fixture Hardware Manufacturing, 4116 First Avenue, Brooklyn, NY 11232 Tel: 718 499-9422.
 - 3. Substitutions are permitted subject to Section 01 63 00.
 - B. Basis of Design: Knappe & Vogt 85 ANO series uprights, or equal. Length as indicated on the drawings.
 - 3. Shelf standards shall be slotted channel framing as specified elsewhere in this Section.
 - 4. Shelf Brackets: 16 gauge bookend type, as detailed on drawings.
 - 5. Safety Edging and Edge Banding:
 - A. Materials: Provide stainless steel retainer lip screw fastened to bottom of shelf, extend ½" above shelf surface.
 - B. Laboratory instrument cart shelving: Provide retainer lip on front and back faces.
 - C. Adjustable wall and reagent shelving: Provide retainer lip on front face only.
 - 6. Metal Finish: Factory finish standards and brackets with epoxy powder coating. Color to be selected by the Architect.
 - 7. Stainless Steel Finish: Factory finish standards and brackets with a brushed satin (No. 4) appearance

2.7 OVERHEAD SERVICE CARRIERS

- A. Description:
 - 1. Overhead Service Carriers (OSC) are structurally supported frames constructed of steel framing members as delineated on the drawings. OSC are designed as a means to distribute utilities to movable tables/benches in the laboratory and to provide support for adjustable shelving. Power, data, voice, air, and other specialty gasses are utilities commonly found on these carriers. These utilities will be brought to an umbilical assembly and then connected to the carrier.
- B. Materials:
 - 1. Support Framing: Suspended channel slotted channel framing, with closure strips, as specified elsewhere on this Section.
 - 2. Brake-formed metal: 16 gauge (1.6mm) galvanized steel with epoxy powder-coated finish.
- C. Fabrication:

1. Fabricate and assemble components as detailed on the drawings.
 2. The entire OSC assembly, including vertical and horizontal supports and diagonal braces, shall be securely and rigidly fastened to structural slab above or to a structural grid where provided. All OSC's and components shall be designed to local seismic design standards.
 3. The Laboratory Furniture Contractor shall supply final shop drawings along with structural design drawings and structural calculations which are stamped and wet-signed, and use structural engineer who is registered in the State where the building is constructed.
- D. Coordination: Carefully coordinate location of supports with the work of other Sections.
- E. Finish: As specified for slotted channel framing. Color shall be selected by the Architect.

2.8 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 stainless steel drying racks shall be the product of a single manufacturer.
 - A. Inter Dyne Systems, Inc., 676 Ellis Rd., Norton Shores, MI 49441, Tel: 231 799-8760. website: <http://www.interdynesystems.com/>
 - B. Substitutions are permitted subject to Section 01 63 00 (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 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, 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.

2.9 METAL FABRICATIONS AND FINISH REQUIREMENTS

- 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, and other miscellaneous brake-formed and shop fabricated components and trim, such as required for overhead service carriers.
- B. Materials:
1. Environmental Compliance:
 - A. All steel used in the product fabrication shall comply with the LEED (Leadership in Energy and Environmental Design) Green Building Design and Construction, version 3, 2009 edition, MR Credit 4.
 - B. The manufacturer shall submit documentation (i.e., "Source of Materials", Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled

- content. Such documentation shall be submitted to the Architect for approval - prior to award of contract.
2. Cold rolled sheet steel:
 - A. Recycled Steel Content: A minimum of 20 percent of the steel used for laboratory fabrications shall consist of the sum of post-consumer recycled content plus one-half of the pre-consumer content, based on the cost of the total value of materials.
 - B. Fabricators Scrap: Fabricators shall provide documentation that manufacturing fall-off is recycled to respective steel mills and neither enters the solid waste system nor becomes a product of landfill space.
 - C. Prime grade, roller leveled, and treated at the mill to be free of scale, ragged edges, deep scratches or other injurious effects.
- C. Finish Requirements:
1. Chemical Resistant Finish: Painted finish shall be chemical resistant, dry powder coated finish complying with SEFA 8 M casework specifications for chemical and durability resistance. A letter from a third-party validator, verifying independent test results, shall be submitted to the Architect for approval at time of bid submittal.
 2. Operator Protection: Paint application shall be convenient and easily mastered through robotic application plus manual detailing. The painting process shall be contained and have no solvent odor and be performed in an air conditioned room.
 3. Overspray: Powder overspray shall be captured and resprayed. Efficiency shall be 99 percent effective in coating usage, reducing waste generated. A closed collection system shall be used for overspray that is not reused. Powder overspray, which cannot escape the facility, shall be collected in bulk, eliminating the need for daily replacement/disposal of filter media.
 4. VOC Emissions: Powder paint shall be sprayed and baked with a near zero (0.29 lbs. per gallon maximum) VOC (Volatile Organic Compounds) emissions. All powder coats shall comply with the GS (Green Seal Standard) 11 allowable emissions.
 5. Offgassing: After all steel powder coated parts have cooled from the curing ovens, the coating shall be firm and stable. No further emissions or "Offgassing/Decomposition" vapors shall occur at room temperature.
- D. Metal Casework Color: As selected by the Architect from manufacturer's full color line and complying with finish requirements described above.

2.10 STAINLESS STEEL FABRICATIONS

- A. Applicability: This section applies to stainless steel fabrications, including, but not limited to, work surfaces, drying racks, canopy hoods, sinks, scullery sinks, low slot exhausts, and other miscellaneous brake-formed and shop fabricated components and trim.
- B. Materials:
 1. Environmental Compliance:
 - A. All stainless steel used in the product fabrication shall comply with the LEED (Leadership in Energy and Environmental Design) Green Building Design and Construction, version 3, 2009 edition, MR Credit 4.
 - B. The manufacturer shall submit documentation (i.e., "Source of Materials", Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled content. Such documentation shall be submitted to the Architect for approval - prior to award of contract.
 2. Stainless Steel Sheet: Unless otherwise noted stainless steel shall be Type 304 and shall be of gauge indicated on Laboratory Furnishing drawings or this specification.
 3. Recycled Steel Content: A minimum of 20 percent of the stainless steel used for laboratory fabrications shall consist of the sum of post-consumer recycled content plus one-half of the pre-consumer content, based on the cost of the total value of materials.

4. 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 No. 4 finish.
 5. 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.
- C. Finish: All fabrications shall have exposed surfaces ground and polished to a No. 4 satin finish.
- D. Work Surfaces:
1. Thickness: 16 gauge.
 2. Fabrication:
 - A. Edges: Flanged down the same dimension as the adjacent non-stainless top, if any, with 1 inch being a minimum and returned over a 16 gauge perimeter metal frame to simplify securing top material to cabinet or structural frame, insure rigidity and prevent buckling, warping, or oil canning.
 - B. Reinforcement: Under-surface shall be reinforced with full length 16 gauge structural metal channels at rear and middle top to insure rigidity and prevent buckling, warping, or oil canning. Where bench-mounted fittings are indicated on the drawings, provide top reinforcement to allow for rigid, secure mounting of fittings.
 - C. Undercoating: Underside of top shall have a heavy mastic agent coating providing sound deadening.
 - D. Stainless steel sides and back-splashes, where indicated, shall be integrally welded to top and finish as indicated above. The back side of exposed backsplashes shall be finished to match front and sides.
 - E. 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 IN. After sawing, rout and file cutouts to ensure smooth, crack-free edges with no burrs.
 - F. Marine edges: Where indicated on the Laboratory Furnishing Drawings and at all sinks with dimensions to match size of sink base cabinet, shall be 1 IN wide and 1/4 IN high with chamfered or radiused transition to and be an integral part of the work surface. Marine edges shall be seamless die-formed.
 3. Tops with Sinks: Tops and sinks shall be integral, fabricated with a marine edge and shall be pitched to sink bowl for proper drainage.
 4. Flat Stainless Steel Work Surfaces (without marine edge or sink): Provide an integrally coved back splash and bull-nose at front of work surface.
- E. Cup Sink: All cup sinks in stainless steel work surfaces and fume hoods shall be integral one piece construction with top. Cup sinks at fume hoods shall have 1/4 inch (6mm) high lip.
- F. Laboratory Sink: Integral one piece construction with stainless steel work surface.
1. Thickness: 16 gauge (1.6mm), unless otherwise noted.
 2. Construction: Sink units shall be designed and fabricated with sufficient reinforcement to prevent oil canning. All sink joints shall be butt-welded, ground smooth by the heliarc welding process. Inside radii shall be 1 inch (25mm). Bottoms shall be pitched to the drain indent. No soldering will be permitted in connection with sink construction. Sink bowl dimensions given are inside dimensions. Underside shall have a heavy mastic agent coating providing sound deadening.
- G. Canopy Hood: Provide stainless steel canopy with all hangers and miscellaneous hardware at locations and sizes as indicated on the Laboratory Furnishing drawings.
2. Thickness: 18 gauge.

3. Construction: Provide reinforcing necessary to prevent "oil canning" or deflection of panel between supports. All corners and joints shall be welded, ground smooth and free of all defects. Welded joints with visible burn marks will not be accepted. Form with condensation gutter. Provide welded exhaust collar with no open seams.
4. Accessories: Provide stainless steel hangers and miscellaneous support hardware as required for a complete installation.
5. Light fixtures and wiring shall be provided under Division 26. Holes for electrical work shall be made by canopy hood fabricator.
6. Provide exhaust duct transition piece for mechanical connection above the ceiling. Refer to Exhaust Schedule for exhaust rate and size.

2.11 SLOTTED CHANNEL FRAMING

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All slotted channel framing components shall be the product of a single manufacturer.
 1. Unistrut, 35660 Clinton Street, Wayne, MI 48184, Tel: 800 521-7730. website: <http://www.unistrut.com/>
 2. Power Engineering Co. (Powerstrut), 420 Boston Turnpike, Shrewsbury, MA, Tel: 800 274-1303. website: <http://www.powerstrut.com/>
 3. Kumar Industries, 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. Substitutions are permitted subject to Section 01 63 00.
- 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 IN by 1 5/8 IN cross-section, unless noted otherwise.
- C. Components:
 1. The following components shall be provided, unless otherwise noted:
 - A. Framing Channel: 1 5/8 IN by 1 5/8 IN by 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 IN by 1-5/8 IN by 12 gauge: Unistrut P5000, Powerstrut PS 100, Kumar Industries N-150, B-Line Systems, Inc. B11, or equal.

- C. Slotted Hole Framing Channel, 1-5/8 IN by 1-5/8 IN by 12 gauge framing channel with 13/32 IN by 3 IN slotted holes, 4 IN on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S.
 - D. Slotted Framing Channel for installation in Chemical Fume Hoods, 1 5/8 IN by 13/16 IN by 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 IN by 1-7/8 IN by 1/8 IN, 4 hole, stainless steel 90 degree fitting: Unistrut P6325 SS, Powerstrut, Kumar Industries, B-Line Systems, Inc.
 - E. Vertical Posts: 3-1/4 IN by 1-5/8 IN by 12 gauge, double channel section: Unistrut P1001, Powerstrut PS 200 2T3, Kumar Industries N-200-A, B-Line Systems, Inc. B22A, or equal.
 - F. Horizontal Support Members: 1-5/8 IN by 1-5/8 IN by 12 gauge framing channel with 13/32 IN by 3 IN slotted holes, 4 IN on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S, or equal.
 - G. Diagonal Brace Supports: Framing Channel, 1-5/8 IN by 1-5/8 IN by 12 gauge: Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equal.
 - H. 90 Degree Angle Fitting: 4-1/8 IN by 3-1/2 IN by 1/4 IN with two holes, each leg: Unistrut P1325, Powerstrut PS 607, Kumar Industries N-1123, B-Line Systems, Inc. B104, or equal.
 - I. 135 Degree Angle Fitting: 3 IN by 2-5/16 IN by 1/4 IN with one hole, each leg: Unistrut P1546, Powerstrut PS 633-45°, Kumar Industries N-1425, B-Line Systems, Inc. B154, or equal.
 - J. T-Shaped Flat Plate Fitting: 5-3/8 IN by 3-1/2 IN by 1/4 IN plate, T-shaped, with four holes: Unistrut P1031, Powerstrut PS 714, Kumar Industries N-1022, B-Line Systems, Inc. B133, or equal.
 - K. Wing Shape Fitting, 9-5/32 IN by 3-7/8 IN 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.
 - L. Closure Strip: 0.04 IN 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 IN 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 IN by 1-5/8 IN 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 IN, maximum, and fastened top and bottom by two adjustable U-shaped spreaders.
 - B. U-shaped spreaders: 12 gauge by 1-1/2 IN 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 IN on center below island and peninsula benches, as indicated on drawings. Support struts shall be provided along wall 48 IN on center below island and peninsula benches. Struts will be used to support piped and electrical services installed under Divisions 23 and 26. Provide all bolts, expansion sleeves, and fastening devices for a complete assembly. Pipe and conduit hangers shall be provided by Division 23 and 26 installers.
3. Adjustable Wall Shelving:
 - A. Shelf Standards: Framing channel, spaced equally, 36 inches (915mm) 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.
- D. Finish:
 1. Provide finish coating for all cold-formed framing components, except for stainless steel components.
 2. 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.
 3. Exposed Framing Members and Fittings: Factory applied epoxy powder coat. Color: To be selected by the Architect.

2.13 LAB COAT HOOKS

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory service fittings specified in this section shall be provided by a single manufacturer.
 1. Bobrick Washroom Equipment, Inc. 11611 Hart Street, North Hollywood, California 91605-5882. Tel: (818) 764-1000. website: <http://www.bobrick.com/>.
 2. Substitutions are permitted subject to Section 00440 and 01640.
- B. Description: Stainless Steel Hook Strip
 1. B-232
 2. 4" high hook strip shall be constructed of 18-gauge (1.3-mm), type-304 stainless steel with satin finish.
 3. Hooks: 1" W, 6'1/2" H (25 x 165mm); project 2-1/4" (55mm) from wall Hooks shall be constructed of 12-gauge (2.8-mm) type-304 stainless steel
 4. Each hook shall be attached to mounting strip with two stainless steel screws and hex nuts.
 5. **14A:** 4 hooks, 30" length
 6. **14B:** 2 hooks, 18" length

2.14 SAFETY GLASS HOLDER

- C. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory service fittings specified in this section shall be provided by a single manufacturer.
1. Lab Safety Supply, Inc., PO Box 1368 Janesville, WI 53547-1368. Tel: (800) 356-0783. website: <http://www.labsafety.com/>.
 2. Substitutions are permitted subject to Section 00440 and 01640.
- D. Description: Wall mounted safety glasses dispenser with Lid
1. Item # 151958
 2. Clear PETG construction with foam pads to prevent scratching.
 3. 9"H x 3 1/4" W x 6 3/4" D

2.15 SOAP DISPENSER

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory service fittings specified in this section shall be provided by a single manufacturer.
1. Bobrick Washroom Equipment, Inc., 11611 Hart St., North Hollywood, California. Tel: (818) 982-9600. website: <http://www.bobrick.com/>.
 2. Substitutions are permitted subject to Section 00440 and 01640.
- B. Description: Surface mounted soap dispenser
1. Item # B-2111
 2. Type-304 stainless steel with satin finish,
 3. Corrosion-resistant valve shall dispense commercially marketed all-purpose hand soaps.
 4. Valve shall be operable with one hand and with less than 5 pounds of force to comply with barrier-free accessibility guidelines.
 5. Unit shall have a concealed, vandal-resistant mounting.
 6. Container shall be equipped with an unbreakable, clear acrylic refill-indicator window and a locked, hinged stainless steel lid for top filling
 7. 8 1/8"H x 4 3/4" W x 2 3/4" D.
 8. Capacity: 40-fl oz.

2.16 PAPER TOWEL DISPENSER

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory service fittings specified in this section shall be provided by a single manufacturer.
1. Bobrick Washroom Equipment, Inc., 11611 Hart St., North Hollywood, California. Tel: (818) 982-9600. website: <http://www.bobrick.com/>.
 2. Substitutions are permitted subject to Section 00440 and 01640.
- B. Description: Surface mounted paper towel dispenser
1. Item # B-262
 2. Type-304 stainless steel with all-welded construction, exposed surfaces shall have satin finished.
 3. Door shall be secured to cabinet with a full-length stainless steel piano-hinge and equipped with a tumbler lock.
 4. Paper towel tray shall have hemmed opening to dispense paper towels without tearing.
 5. Unit shall be capable of dispensing 400 C-fold or 525 multifold paper towels measuring 3 1/8" to 3 13/16" deep.
 6. 14 1/16" H x 10 13/16" W x 3 15/16" D

2.17 SEALANT

- A. Refer to Section 07 92 00.
- B. Sealant shall be installed by installer of the work of this Section.

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. Project Conditions: Casework and furnishings shall not be delivered and installed prior to completion of the followings items:
 - 1. Windows and doors shall be installed and the building shall be weather-tight.
 - 2. Finished ceilings, if specified, overhead ductwork, piping, electrical, and lighting work shall be installed.
 - 3. Painting shall be complete.
 - 4. Flooring shall be installed.
 - 5. Interior building temperature can be maintained between 65 and 80 degrees F, and ambient relative humidity can be maintained between 25 percent and 55 percent prior to delivery and during and after installation. Frequent and/or excessive changes in temperature and/or humidity levels during casework installation, or once casework is installed, must be avoided to prevent damage to materials.
- C. Discrepancy: In the event of discrepancy, immediately notify the Architect.

3.2 INSTALLATION

- A. Installation of items specified in this Section shall be performed by installers experienced in the installation of the respective item as determined by the respective manufacturer.
- B. Coordinate work with any Laboratory furnished and/or installed components indicated on drawings.
- C. Casework:
 - 1. Set casework items plumb, level, and true. Shim as required, using concealed shims for a plumb, level, true and straight installation. All items shall be securely anchored.
 - 2. Where required, assemble units into one integral unit with joints flush, tight, and uniform.
 - 3. Provide matching filler pieces where casework abuts walls or columns, or should be closed off.
 - 4. Install hardware uniformly and precisely. Set hinges snug and flat in mortises. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly, and so that doors and drawers operate without warp or bind and contact points meet accurately.
 - 5. Secure base cabinets to service struts and ledging, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches (600mm) on center. Bolt adjacent floor mounted cabinets together with joints flush, tight, and uniform.
 - 6. Floor mounted casework shall receive top set or integral base as specified under Division 09 and on the Finishes drawings.
 - 7. Suspended Casework, Wall Cabinets, and Shelving:
 - A. Fasten suspended and wall cabinets to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through the back, near top, at not less than 24 inches (600mm) on center.
 - B. Securely fasten to solid supporting material; not plaster, lath, or wallboard. Anchor, adjust, and align suspended casework, wall cabinets, and shelving supports as specified for base cabinets.

- C. Blocking and backing in cavity wall construction for suspended casework, wall cabinets, and shelving shall be as specified under Division 09, and shall be installed under the scope of work of other Sections. General Contractor shall coordinate the location of in-wall blocking and backing using the shop drawings provided under this Section. Verify that all required backing and reinforcement necessary to support wall-mounted units is in place, secure, and accurately located.
- D. Laboratory Tops:
1. Scribe tops as necessary for close and accurate fit.
 2. 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.
 3. 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.
 4. Epoxy Resin: Cement joint in accordance with the manufacturers' specifications.
 5. Stainless Steel: Field weld joints in stainless steel tight, without open seams. Finish material to match adjacent to weld.
- E. Tolerances: Casework shall not exceed the following tolerances:
1. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch in 10 feet (3mm in 3m).
 2. Variation of Cabinet Faces from a True Plane: 1/8 inch in 10 feet (3mm in 3m).
 3. Variation of Adjacent Surfaces from a True Plane: 1/32 inch (0.8mm).
 4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5mm).
 5. Variation of Work Surfaces from Level: 1/16 inch in 10 feet (1.5mm in 3m).
- F. Laboratory Sinks
1. Epoxy Resin, Undermount: Sinks shall be set in work surface with chemical-resisting sealing compound, secured and supported in accordance with manufacturer's instructions. Adjust sink and securely support to prevent movement. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.
 2. Epoxy Resin and Polypropylene Cup Sinks, Drop In: Set sink in adhesive and fill remainder of rabbet with sealant or adhesive. Use procedures recommended by sink and work surface manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.
 3. Epoxy Resin and Polypropylene Cup Sinks, Top Mount: Set sink in adhesive. Use procedures recommended by sink and work surface manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.
 4. Stainless Steel, Top Mount: Before setting, apply sink and work surface manufacturers' recommended sealant under rim lip and along work surface. Remove excess sealant while still wet and finish joint for neat appearance.
- G. Miscellaneous Furnishings and Accessories:
1. Install in accordance with manufacturer's instructions.
 2. Securely fasten wall mounted adjustable shelving supports, stainless steel shelves, drying racks, etc. to partition framing, wood blocking, or reinforcements in partitions.
 3. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.
 4. Tighten screws to seal flat; do not drive.
- H. Sealant:
1. Caulk edges of tops, backsplashes and side splashes to adjacent wall surface, and around all work surface penetrations, with sealant.

2. Sealant application shall be in accordance with manufacturer's published recommendations.
- I. Repair or remove and replace defective work as approved by the Architect at no additional cost to the Laboratory.
 1. Where approved by Architect, touch-up finishes applied to damaged surfaces shall have a VOC content of no more than 250 g/L in accord with SCAQMD Rule #1168.
 - J. Adjustable Laboratory Furniture System:
 1. Support system locations shall be established from approved shop drawings so that mechanical and electrical work can be installed without interfering with installation.
 2. Installation of support system shall be coordinated with the trades to maintain the integrity of the installed system.
 3. Support system assemblies, ancillary components and accessories shall be installed with the supervision of the manufacturer's authorized representative and according to manufacturer's recommendations.

3.3 CLEANING

- A. Clean finished units, touch up as required, and remove and refinish damaged or soiled areas.
- B. Clean counter tops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

3.4 PROTECTION

- A. Cover tops with 1/4 inch (6.35mm) corrugated cardboard, secured in place, after installation for protection against scratching, soiling, and deterioration during remainder of construction period. Remove protection prior to final cleaning.

END OF SECTION

SECTION 12 36 37
RECYCLED GLASS PCC COUNTERTOPS (RFG)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Recycled Glass Portland Cement Countertops, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicable standards:
 - 1. Standards of the following, as referenced herein:
 - a. American National Standards Institute (ANSI).
 - b. American Society for Testing and Materials (ASTM).
 - c. NSF International.
- B. NSF/ANSI standards:
 - 1. Refer to www.nsf.org for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.
- C. Fabricator/Installer Qualifications:
 - 1. Firm that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- D. Source Limitations: Obtain materials and products from single source.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
 - 2. Show full-size details, edge details and attachments.
 - 3. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement.
 - 4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in surface.
 - 5. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples:
 - 1. For each color selected:
 - a. Minimum 4 IN x 4 IN sample of each color specified.
 - b. Cut sample and seam together for representation of inconspicuous seam.
 - c. Indicate full range of color and pattern variation.
 - 2. Sealant colors for selection.
 - 3. Approved samples will be retained as a standard for work.
- C. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Warranty.
- D. LEED information:

1. MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
2. MR 5.1 & 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesives and sealants including VOC content for products used in this section.

1.4 WARRANTY

- A. Provide 1-year manufacturer's warranty including colorfastness and material defects.
 1. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Recycled Glass Portland cement Countertops:
 1. Base:
 - a. As noted in Room Finish and Color Schedule, 09 06 10.
 2. Optional:
 - a. Rinato by Terrazzo and Marble Supply
 - 1) Optional manufacturer must custom match samples as noted in Room Finish and Color Schedule, 09 06 10.
- B. Other manufacturers desiring approval comply with section 00 26 00.

2.2 RECYCLED GLASS PORTLAND CEMENT COUNTERTOPS

- A. Material Description:
 1. Aggregate comprised of 100 percent recycled glass.
 - a. Recycled glass food or beverage containers free of debris and manufactured from an approved supplier of crushed cullet.
 - b. Glass aggregate shall be free of debris such as paper, metals, clay, loam or other materials that would be associated with the glass recycling process.
 2. Portland cement: ASTM C-150 Specifications for Portland cement.
 - a. Type 1 colored Portland Cement shall be used in concrete mix.
 - b. Countertops shall be fabricated to dimensions indicated.

Minimum Physical Properties		
Property	Method	Value
Food Safety	NSF/ANSI 51	
Compressive Strength	ASTM C 39	
Absorption	ASTM C-97-02	0.79%
Scratch Resistance	Mohs Hardness	7.5 Glass / 4.75 Matrix
Modulus of Rupture	ASTM C-99	1,004 psi
Radon	EPA-402-R-92-004	< 0.5 pCi/L*

2.3 MISCELLANEOUS MATERIALS

- A. Adhesive:

Argonne National Laboratory Energy Sciences Building 241
ANL Document No. J241-101-W-T015 Issued for Proposal - 3/7/11

12 36 37 - 2

1. Manufacturer's standard adhesive as required for inconspicuous, non-porous joints.
- B. Sealant (elastomeric):
1. Description:
 - a. Mildew-resistant, FDA-compliant, NSF 51-compliant, UL-listed silicone sealant in colors matching components.
 - b. Specifically formulated for applications indicated, including wet areas.
 - c. Elastomeric.
 - d. Shore A Hardness: 25.
 - e. Compatible with glass surfacing.
 - f. VOC content shall be no greater than 250 g/L.
 2. Colors:
 - a. Architect to select from manufacturer's standard color choices.
 - b. Number of different colors required for project shall not be limited.
 3. Base Product(s):
 - a. Solid Colors: "Color-Sil" by Color Rite; 100% Silicone, no suspended particles.
 - b. Speckled Colors: "Poly-Sil" by Color Rite; includes polymers suspended in 100% Silicone.
 - c. Architect to select final colors and locations during submittals phase.

2.4 SHOP FABRICATION – GENERAL

- A. Assemble work at shop and deliver to Project ready for installation.
1. Fabricate recycled glass cement terrazzo in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
 2. No joints are allowed in finished product.
 3. Cut and drill sinkages and holes in countertops for anchors, supports and attachments.
 4. Finish exposed faces to comply with approved samples.
 5. Configurations as indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Verify measurements, dimensions and drawing details before proceeding.
 2. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
 3. Examine conditions under which work is to be installed.
 4. Correct unsatisfactory conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. General:
1. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 2. Provide product in the largest pieces available.
 3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams will not be allowed.
 4. Cut and finish component edges with clean, sharp returns.
 5. Rout radii and contours to template.

6. Anchor securely to base cabinets or other supports.
 7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 9. Install countertops with no more than 1/8 IN sag, bow or other variation from a straight line.
- B. Countertops:
1. Install plumb, level, true and straight.
 - a. Shim as necessary using concealed shims.
 2. Adhere tops to base cabinets as recommended by manufacturer..
 3. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
 - a. Supply additional wood supports, spaced no more than 12 IN apart or as otherwise required for adequate strength.
 - b. Restrict unsupported overhangs to 12 IN.
 4. Where tops are abutted by walls at both ends: 1/8 IN expansion gaps at both ends for every 10 FT countertop.
 - a. Seal gaps with elastomeric sealant.
- C. Sinks (specified elsewhere):
1. Install sinks per Section 22 42 00.
 2. Seal to Countertop with elastomeric sealant and mounting hardware provided.
 3. Drain and overflow connections: Specified in Section 22 42 00.
- D. Backsplashes and Sidesplashes:
1. Applied Splashes:
 - a. Join "adhered" items to substrate using color-matched, elastomeric sealant.
 - b. Adhere to walls and other substrates with clear silicone sealant.
 - c. Seal to walls and adjacent cabinets with color-matched, elastomeric sealant.
- E. Faucets and Trim:
1. Install faucets and trim per Section 22 42 00.
 2. Plumbing connections: Specified in Section 22 42 00.
 3. Seal to Countertop with elastomeric sealant.

3.3 CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Protect finished surfaces from damage.
- C. Remove adhesives, sealants and other stains.

3.4 REPAIR

- A. Repair damaged work.
- B. Replace damaged work which cannot be repaired to Architect's satisfaction.

END OF SECTION

SECTION 12 48 23
ENTRANCE GRIDS (EG)

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Minimum Performance Standard Compliance:

Minimum Physical Properties		
Property	Test Method	Required Value
Flammability	ASTM-E648	Class I
Critical Radiant Flux	ASTM-E648	0.45 Watts/M ²
Slip-Resistance	ASTM-D2047	Wet and Dry $\mu \geq 0.6$

B. Single Source Responsibility:

1. Obtain grids and frames from one source.

C. Reference Standards:

1. American Society for Testing and Materials (ASTM)
2. The Aluminum Association
3. The Carpet and Rug Institute (CRI)
4. The National Floor Safety Institute (NFSI).

D. Dissimilar materials protection:

1. Where aluminum materials will be in contact with concrete or other incompatible materials:
Provide a suitable protective coating.

E. Splices:

1. General:
 - a. Manufacturer shall be capable of producing Tread Rails in lengths of at least 12 FT.
 - b. Show proposed splice locations on Shop Drawings for Architect approval.
2. Where Entrance Grids on project are less than 12 FT wide:
 - a. No splices will be permitted.
3. Where Entrance Grids on project are greater than 12 FT:
 - a. Locate splices away from primary pathways.
 - b. Utilize maximum practical lengths of Tread Rails.

1.2 SUBMITTALS

A. Shop Drawings:

1. Showing layout of grids and frames specified including details indicating construction relative to materials, direction of traffic, splices, spline locations, profiles, anchors and accessories.

B. Product Data:

1. Manufacturer's specifications for each type of floor grid and frame specified.

C. Samples:

1. Materials, finishes and colors for approval.

D. Product Data:

1. Manufacturer's installation instructions for each type of floor grid and frame specified.
2. Certification of Slip-Resistance rating.

E. Contract Closeout Information:

1. Maintenance data.
 2. Warranty.
 3. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- F. LEED Information:
1. MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver embedded anchorage items in time for installation.
- B. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

1.4 PROJECT CONDITIONS

- A. Field measurements:
 1. Check actual openings for grids by accurate field measurements before fabrication.
 2. Record actual measurements on final Shop Drawings.
 3. Coordinate fabrication schedule with construction progress to avoid delay of work.
- B. For recessed applications:
 1. Coordinate frame installation with concrete construction to ensure recess and frame anchorage are accurate and that the base is level and flat.
 2. Defer frame installation until building enclosure is complete and related interior finish work is in progress.
- C. Deviations from Specified Thicknesses:
 1. Units proposed by Optional Manufacturers, where the nominal thickness of their products differ from that of the Base Product:
 - a. Seek prior approval of thickness deviation from Architect.
 - b. Notify Contractor/CM so that compensation in substrate and abutting finishes can be coordinated.

1.5 WARRANTY

- A. Manufacturer's standard 2-year warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Entrance Grids (EG):
 - a. Base:
 - b. As noted in Room Finish and Color Schedule, 09 06 10.
 - c. Optional:
 - 1) Balco Inc.
 - 2) JL Industries.
 - 3) Mats Inc.
 - 4) Arden Architectural Specialties.
 - 5) Reese Enterprises.
 - 2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 ENTRANCE GRID UNITS

- A. Description:
 - 1. Product includes a common mud plate and bond breaker with stainless steel top surface sections that are removable Extruded tread rails joined mechanically by extruded aluminum key lock bars.
 - 2. Base Product: As noted in Room Finish and Color Schedule, 09 06 10.
 - 3. Capacity Rating:
 - a. Standard rolling load performance: 00 LBS wheel load.
- B. Level Base Frame (1-11/16 IN Deep) w/out Drain:
 - 1. Frame Material: 6063-T5/T6 alloy aluminum with finish on exposed pieces matching finishes specified for visible portions of Tread Rails.
 - 2. Include extruded vinyl fillers at leading and trailing edges.
 - 3. Include required fillers, inserts fasteners and other accessories.
 - 4. Dissimilar materials protection: Where raw aluminum will be in contact with concrete: Provide a suitable protective coating.
 - 5. Frame transitions to abutting materials shall comply with ADA.
 - 6. Drain and Drain Pan: Not required.

2.3 WATERPROOF COATING

- A. Description:
 - 1. Fluid-applied waterproof flooring system applied to floor recesses prior to installing Entrance Flooring Grids.
 - 2. Primer: As recommended by system manufacturer.
 - 3. Membrane Component: Neoprene, elastomeric.
 - 4. Base Product: "Dex-O-Tex M-E Flooring (Type NR)" by Crossfield Products.
 - a. Optional: Similar products by NeoGard and Tremco.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Clean substrate prior to installation of grid.
- B. Verification of conditions:
 - 1. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

- C. Verify suitability of substrate to accept frame and grid.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped grid assemblies to ensure a proper installation.

3.3 INSTALLATION

- A. Install the work of this section in accordance with the manufacturer's recommendations.
- B. Set grid at height recommended by manufacturer for most effective cleaning action.
- C. Utilize latex screed to ensure level base.
 - 1. Product to be approved by manufacturer of Entrance Grid.
- D. Waterproof Coating:
 - 1. Install Waterproof Coating over floor recess per manufacturer's instructions.
- E. Coordinate top of grid surfaces with bottom of doors that swing across to provide clearance between door and grid.

3.4 PROTECTION

- A. After completing required frame installation and concrete work, defer installation of Tread Rails until time of substantial completion of project.
 - 1. In meantime: Provide temporary filler plywood or fiberboard in recess, and cover frames with plywood protective flooring.
 - 2. Maintain protection until construction traffic has ended and project is near time of substantial completion.

3.5 CLEANING & REPAIRS

- A. Adjust and clean prior to final acceptance.
- B. Train Laboratory's maintenance personnel of proper cleaning/maintenance procedures.

END OF SECTION

SECTION 12 48 26
NYLON ENTRANCE TILE (NET)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Nylon Entrance Tile (NET), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Samples:
 - 1. 12 IN x 12 IN sample of color specified.
 - 2. Carpet edging standard colors.
- B. Contract closeout information:
 - 1. Warranty.
 - 2. Maintenance data.
 - 3. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.
 - 3) See Section 01 78 26.
- C. LEED Information:
 - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
 - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 3. EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data indicating VOC content of adhesive.
 - 4. EQ 4.3, Low-Emitting Materials, Carpet Systems: Product data indicating that all carpet systems comply with Carpet and Rug Institute Green Label Plus program and carpet cushion complies with Carpet and Rug Institute Green Label program.

1.3 WARRANTY

- A. Warrant that entire installation complies with specifications, and that damaged or defective tiles, or tile stained by adhesives will be removed and replaced.
- B. Warrant that tiles will not show excessive wear for a period of 10 years from date of acceptance.
 - 1. Excessive wear is defined as wearing away of face yarns which reduces pile height by more than 10 percent in any area or pulling out of nap.
- C. Warrant entire cost of replacement, including removal, replacement, and disposal of defective tiles.

- D. Written warranty to be jointly signed by Contractor, installer and manufacturer.
- E. Guarantee against manufacturing defects.
 - 1. Dimensional stability.
 - 2. Delamination.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nylon entrance tile:
 - 1. Base:
 - a. As noted in Room Finish and Color Schedule, Section 09 06 10..
 - 2. Optional:
 - a. Interface Flooring Systems.
- B. Tile Edging:
 - 1. Base:
 - a. Roppe
 - 2. Optional:
 - a. Mercer Products
- C. Adhesives:
 - 1. Base:
 - a. 3M.
- D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Nylon entrance tile:
 - 1. 100 percent nylon tufted loop pile.
 - 2. Yarn weight: 238 OZ/SQ YD.
- B. Carpet edging:
 - 1. Thickness to match carpet.
 - 2. Color as selected by Architect.
- C. Adhesive:
 - 1. Non-staining, non-bleeding strippable type as recommended by tile manufacturer.
 - 2. Adhesives used for carpet installation shall have a VOC content of no greater than 50 g/L.
 - 3. Sealants used in application for carpet systems shall have a VOC content of no greater than 250 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation,
- B. Examine substrate for moisture content.
 - 1. Test for moisture with a hygrometer or a moisture test unit (developed by Rubber Manufacturers Association.
 - 2. Correct if hygrometer readings are greater than 65 percent at 60 degF or above.
- C. Examine substrate for alkalinity.
 - 1. Correct if PH reading is greater than 10.

3.2 PREPARATION

- A. Clean all areas to receive tile.
 - 1. Seal new concrete.
- B. Remove dust and vacuum, wet mop and seal concrete.
- C. Fill all cracks, joints, holes or uneven areas with non-crumbling manufacturer approved latex base floor filler.
- D. Test for "open-time" bond before commencing work.

3.3 INSTALLATION

- A. Install in accord with manufacturer's instructions.
- B. Arrange joints symmetrically about centerline of space.
- C. Install reducer strip where tile terminates at adjacent flooring material.

3.4 CLEANING AND PROTECTION

- A. Remove any spillage of glue or adhesive from face or seam using remover provided by manufacturer.
- B. Vacuum thoroughly.
- C. Advise maintenance personnel regarding care and maintenance.
- D. Protect tile after cleaning and prior to final acceptance with vinyl runners or other approved material.

END OF SECTION

SECTION 13 21 14
CONTROLLED ENVIRONMENT ROOMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

1. Pre-fabricated, Pre-engineered, Controlled Environment Rooms, including:
 - 1) Controlled Temperature Rooms:
 - a) Cold rooms.
 - b) Warm rooms.
 2. Associated Components and Systems.

1.2 UNDIVIDED RESPONSIBILITY

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

1.3 REFERENCES

- A. UL Label: Underwriter's Laboratories Label of Approval for all components including wall panels.
- B. National Electric Code (NEC):
 - 1) Article 310: Conductors for General Wiring.
 - 2) Article 430: Motors, Motor Circuits, and Controllers.

1.4 DESCRIPTION

- A. Furnish and install laboratory controlled environment rooms complete with all necessary equipment, controls, accessories, and hardware and coordinate lighting and power with Division 26 to insure a complete installation to perform intended function as specified herein, shown on the Laboratory Furnishings Drawings and Mechanical Drawings. Refer to Controlled Environment Room Schedule.
- B. Where Controlled Temperature and Controlled Environment rooms are designed with common connecting walls, provide each room with independent control airflow and mechanical systems.
- C. Maintain overall noise levels in enclosures during steady state control conditions below NC-65 curve over audible frequency range as measured by standard ASA methods when external ambient noise level is 85 decibels or less.
- D. Controlled Environment Rooms shall be commissioned. Refer to Section 01 91 00.

1.5 SUBMITTALS

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalog and technical data, of all materials, equipment, and products for Work in this Section. Indicate type of refrigerant to be used.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules. Show plans, elevations, and sections at not less than 1/4 inch scale, and details at not less than 1-1/2 inch scale. Show relationship to adjoining materials, construction, and structure above, fasteners, doors, hardware, maintenance access to equipment, finishes, supplementary support or bracing, data sheets for all control devices, lighting fixtures, electrical receptacles, controls and services, locations and sizes of access ports, and relationship to utilities. Provide piping, wiring, and/or control diagrams, indicating all connection points and sizes to building services and systems. Provide flow rates, pressure drops, temperature and pressure requirements, voltage and amperage, sensor locations, etc. Provide clear identification where equipment requirements deviate from the service/utility provisions identified in the Construction Documents. Clearly identify terminal blocks for Division 25 building automation system. 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.
- D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements.
 - 1) Controlled environment rooms shall be designed and anchored in accordance with IBC Seismic Design Category C requirements.
- E. Samples:

- 1) Panel Finish: Submit three (3) 12 inch by 12 inch samples of each type of specified exposed finish.
 - 2) Floor Finish: Submit three (3) 12 inch by 12 inch samples of each type of specified floor finish and color range available.
- F. Certification and Test Results.
- G. Informational Submittals:
- 1) Specimen of Special Warranty.
 - 2) Electrical: Illumination calculations demonstrating compliance with the design requirements herein, under operating temperatures of room.
 - 3) Structural: Calculations, when applicable: Signed and sealed by Professional Structural Engineer.
 - a. Roof design structural calculations.
 - b. Seismic control calculations.
- H. Operations/Maintenance Manuals: Submit complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and closest factory representative for components.

1.6 QUALITY ASSURANCE

- A. Qualifications: Manufacturer shall have a minimum of 10 years of documented experience producing controlled environment rooms, with not less than 50 similar projects in successful use for not less than 5 years. Manufacturer shall have 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 specified for research facilities, with skilled personnel, factory trained workmen and an experienced engineering department. Upon request, manufacturers shall produce evidence of financial stability and bonding capacity required to perform on this project. The manufacturer must stock materials for emergency and routine maintenance.
1. Installer shall have a minimum of 10 years of successful installation of scientific controlled environment rooms and systems.
 2. Manufacturer and installer 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 REGULATORY REQUIREMENTS

- A. Conform to applicable state and local building codes for noncombustible construction and flame spread and smoke development requirements.
1. Door hardware shall comply with the state and local building requirements for accessibility for the disabled.

1.8 PRODUCT HANDLING

- A. Wrap and crate finished components and assemblies at factory to prevent damage or marring of surfaces during shipping and handling.
1. Do not deliver materials or assemblies to site until installation spaces are ready to receive units.
 2. 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 damage as a result of this contractors work shall be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to the Laboratory.

1.9 COORDINATION

- A. Work in this Section requires close coordination with Work in Electrical, Mechanical and Architectural 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. It is the responsibility of the Controlled Environment Room manufacturer to inform the General Contractor and/or Construction Manager of any variations from the Drawings and Specifications associated with these coordination items for the manufacturer's products and engineering.

- B. The Work of this Section includes installation of all piping, tubing, wiring and associated component materials necessary from Controlled Environment Rooms to compressors remotely located, verify location with mechanical drawings. Provide routing, chase, access and layout drawings and diagrams required to accomplish this Work. Access routes and chases, penetrations through horizontal and vertical floor and wall surfaces shall be provided by other Sections of this specification based on these drawings. Seal all penetrations with a chemical resistant sealer and comply with requirements of the building and fire protection codes.
- C. Structural Coordination:
 - 1) The Controlled Environment Room Contractor has full responsibility for the following:
 - a. Provide structural backing for all wall mounted laboratory furnishings and equipment as shown on the Laboratory Furnishing drawings.
 - b. Coordinate depth of recess in concrete slab or deck with Division 03.
- D. Mechanical Coordination:
 - 1) Refer to Mechanical and Plumbing Drawings for piped services to be provided to room.
 - 2) The Controlled Environment Room Contractor has full responsibility for the following:
 - a. Review the Mechanical Drawings and Controlled Environment Room Schedule to verify that the piped services, if water cooled, are adequate and compatible with the Controlled Environment Rooms.
 - b. Making openings for service penetrations to and from the Controlled Environment Room.
 - c. Coordinate with Division 22 and 23 installers to ensure that all required services are brought to within 60 inches (1.5 m) of the Controlled Environment Room.
 - d. Properly sealing all service penetrations into the Controlled Environment Rooms with silicone caulking.
 - 3) Room plumbing piping shall be installed in accordance with the requirements of Division 22.
 - 4) Condenser cooling water and/or refrigerant piping shall be installed in accordance with the requirements of Division 23.
- E. Electrical Coordination:
 - 1) Refer to the Electrical Drawings for the service voltage power feed, circuit breaker size and outlet type.
 - 2) The Controlled Environment Room Contractor has full responsibility for the following:
 - a. Review the Electrical Drawings and Controlled Environment Room Schedule to verify that the electrical services are adequate and compatible with the Controlled Environment Rooms. Provide all required electrical services.
 - b. Electrical work shall be installed in accordance with the requirements of Division 26.

1.10 SPECIAL WARRANTY

- A. Manufacturer's Guarantee: In addition to guarantees required under other Sections of the specifications, the Contractor shall provide a written guarantee from the manufacturer for each compressor for a period of five years and the prefabricated panels for a period of ten years.

1.11 MAINTENANCE SERVICE

- A. Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled, competent employees of room installer. Include semi-annual preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required to maintain specified or normal operation. Use only parts and supplies as used in manufacturer and installation of original equipment. Perform maintenance, including emergency callback service during normal working hours.

PART 2 - PRODUCTS

3.1 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.

- 1) Environmental Growth Chambers (EGC), P.O. Box 390, Chagrin Falls, OH 44022, Tel: 1-800-321-6854, website: <http://www.egc.com/>
- 2) Bahnson Environmental Specialties, LLC (ES), 4412 Tryon Road, Raleigh, NC 27606, Tel: 1-800-688-5859, website: <http://www.eschambers.com/>
- 3) Controlled Environments Inc. (Conviron), 222 South Fifth Street, Box 347, Pembina, ND 58271, Tel: 701 280-9635, website: <http://www.conviron.com/>
- 4) Insulated Structures, 80 Red Schoolhouse Road, Suite 101, Chestnut Ridge, NY 10977, Tel: 800 887-2635, website: <http://www.insulated-structures.com>
- 5) Harris Environmental Systems, Inc., 11 Connector Road, Andover, MA 01810, Tel: 978 470-8600, website: <http://www.harris-env.com>
- 6) Substitutions are permitted subject to Section 01 63 00.

3.2 DESCRIPTION

- A. Controlled Environment Rooms shall be pre-fabricated, all metal-clad construction, furnished and installed as a complete self-contained unit and system, including essential mechanical equipment, controls, balanced air circulation, lighting, and other equipment necessary to achieve the environmental conditions specified and described on the Drawings. Controlled environment rooms shall be of modular, "sandwich panel" construction. Construction shall allow disassembly for possible relocation or expansion at a later date.
1. Modular Panel Construction:
 - 1) Each panel shall consist of interior and exterior metal skins with a solid core of insulation and shall incorporate an integral mechanical method of fastening and sealing the joints to provide a vapor tight seal. Fabricate panels as interchangeable units, with custom sizes as required to meet building dimensions. Panel edges shall be fabricated as foamed-in-place, tongue-and-groove construction with flexible vinyl gaskets, interior and exterior, to assure tight fitting joints. Provide internal panel reinforcement to support panel-mounted items. Panels shall have no wood components.
 - 2) Skin Sheets:
 - a) Interior skin sheets of all sidewalls and ceiling panels shall be 22 gauge Type 304 stainless steel with a No. 3 or 4 finish.
 - b) Exterior wall skin sheets of all sidewalls shall be 22 gauge Type 304 stainless steel with a No.3 or 4 finish.
 - c) Exterior ceiling skin sheet of ceiling panels shall be 26 gauge stucco-embossed galvanized steel.
 - d) Interior skin sheet of floor panels shall be 14 gauge (2.0 mm) galvanized steel capable of supporting a uniformly distributed loading of 600 lbs/ft² (28.73 kPa).
 - 3) Panel Joints: Panel joints to be secured from inside room with integral mechanical fasteners, such as cam locks or bolted pods. All field joints must be sealed and the resulting joints further sealed by appropriate gaskets or silicone sealant. Batten strips, pressure clips, and other types of framing are not allowed.
 - 4) Insulation:
 - a) Foam insulation shall be EPA Montreal Protocol-accepted, non-toxic, non-flammable fluorocarbon blowing agents, adhered to interior and exterior faces of panels.
 - b) Each panel shall be completely filled with rigid, foamed-in-place urethane having a thermal conductivity (K factor) of 0.133 BTU/hr/sf/degrees F/inch and an overall coefficient of heat transfer (U factor) of not more than 0.0333 per 4 inch panel thickness. Panels, unless specifically noted otherwise, shall be a minimum of R-30.
 - c) Insulation shall have an average, in-place density of 2.3 lb/ft³ (36.84 kg/m³) and compression strength at yield point of 28 psi (193 kPa).
 - d) Insulation shall contain no CFC.
 - e) Insulation shall have flame spread of 25 or lower and smoke generation of 450 or lower when tested in accordance with ASTM E-84-76 and UL 723.
 - 5) Overall Panel Thickness:
 - a) Wall and Ceiling Panels: 4 inches (102 mm).
 - b) Floor Panels: 4 inches (102 mm).

- 6) Ceiling Panel Access: Where equipment above the room cannot be accessed from the ceiling space outside the room, provide removable, gasketed panel for access to equipment above insulated ceiling panels. Access panel shall be approximately 36 inches by 36 inches (915 mm x 915 mm) and of similar insulated sandwich panel construction as ceiling and wall panels, with diamond plate aluminum interior skin. Manufacturer and Contractor shall coordinate need for ceiling access panel.
2. Doors, Non-Rated:
 - 1) Door construction shall be of similar type and thickness as adjoining panels. Door panel shall be constructed to prevent warping, or racking. Doors shall satisfy requirements for accessibility by the disabled.
 - 2) Minimum clear opening to be 36 inches by 78 inches (864 x 1980 mm).
 - 3) Hardware:
 - a) Latch: Door latch shall be self-latching, heavy-duty, chrome plated, solid brass forged handle with key locked door latch allowing interior safety release. Cylinder shall be provided under Section 08 71 00.
 - b) Hinges: Self-closing 180 degree swing hinges with cam action and stainless or plated steel pins with nylon bushings. Hinges shall close door to latch when open within 1 inch (0.25 mm) of full closure. Provide door closer if hinges cannot latch door as specified. Provide door stop at face of controlled temperature room.
 - c) Gasket: Resilient, replaceable, thermoplastic gasket on top and sides of door. Provide resilient, dual blade, thermoplastic or rubber sweep at bottom of door. Jamb and head gasket may have a magnetic core with enough force to create an airtight seal, providing door opening force does not exceed requirements for accessibility by the disabled.
 - d) Threshold: Aluminum saddle with mill finish and thermal break. Threshold shall straddle from floor panel to finished floor outside of room.
 - 4) Perimeter Frame Heating:
 - a) Doors on rooms operating at temperatures above 0 degrees and below 5 degrees C. shall have an anti-sweat heater, maximum 17 W/lf of door frame, to prevent condensation and frost formation. This heater shall be positioned beneath the metal edge of the door frame on all four sides and shall be easily accessible for replacement or service. Door heater shall be factory pre-wired to control panel.
 - 5) Door to incorporate 3-pane observation window, with sealed air spaces, 12 inches by 15 inches (305 x 381 mm), with lightproof cover. Window shall be sealed and provided with either heat-reflective treated gas or gas-fill. Window shall be field replaceable. Windows in rooms operating below 0 degrees C shall have heaters. Windows are not required in rooms operating below -20 degrees C. The bottom edge of the vision panel shall be 43 inches (1090mm) above finished floor.
 3. Ceiling:
 - 1) Provide 24 inch by 48 inch (610 mm x 1220 mm) white acrylic 1/2 inch by 1/2 inch by 1/2 inch (13 mm x 13 mm x 13 mm) or 24 inch by 24 inch (610 mm x 610 mm) lay-in perforated prismatic Lexan (polycarbonate) eggcrate, lay-in ceiling grid supported by 1-1/2 inch by 1-1/2 inch (38 mm x 38 mm) aluminum members with a white baked enamel finish.
 4. Flooring:
 - 1) Wearing surface to be covered with continuous sheet vinyl flooring with 4 inch (102 mm) coved, integral base:
 - 2) Manufacturers: Subject to compliance with requirements, the following manufacturers and products named are acceptable; substitutions of other unnamed manufacturers are not permitted.
 - a) Altro, 224 Nazareth Pike, Bethlehem, PA 18020 Tel: 800 377 5597 website: www.altrofloors.com.
 - 3) Substitutions are permitted subject to Section 01 63 00.
 - 4) Basis of Design Altro "Impressionist II" Safety Flooring, as specified herein.
 - 5) Description: Provide slip resistant sheet vinyl safety flooring which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.
 - a) Slip Resistant Sheet Vinyl: To ASTM F1303, Type 2, Grade 1, sheet vinyl flooring with moisture resistant backing Class A. Static coefficient of slip resistance in excess of 0.6 when tested in accordance with ASTM D2047, with integrated bacteriostat.
 - b) Color: Arctic.
 - c) Temperature Performance: Flooring shall be capable of withstand temperature and low as -4 degrees F (-20 degrees C).

- d) References:
 - (1) ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
 - (2) ASTM E 648/NFPA 253, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - (3) ASTM E662, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - (4) ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - (5) ASTM F 970, Standard Test Method for Static Load Limit.
 - (6) ASTM F1303, Standard Specification for Sheet Vinyl Floor Covering with Backing.
 - (7) ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
 - (8) ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - e) Total Thickness: 0.080 inch.
 - f) Sheet Width: 78 inches, minimum.
 - g) Heat-welded seams.
- 6) Accessories:
- a) Primers and Adhesives: Water-resistant type recommended by floor covering manufacturer for products and substrate conditions indicated.
 - b) Vinyl Heat-Welding Rod.
 - c) Integral Cove Strip: 1 inch radius support for integral flash cove at floor/wall juncture, type "725 Merstick" by Mercer Products Company, Inc., or approved equal, subject to approval of the sheet vinyl materials manufacturer.
 - d) Vinyl Cap Strip: sized to suit application, as recommended by flooring manufacturer.
5. Instruments and Control Systems:
- 1) All instruments, controls and major electrical components, such as circuit breakers, relays and conductors required for operation of Controlled Environment Rooms. The time delay relay shall be adjustable from 0-15 minutes. All instruments, controls, lighting, receptacles, switches, etc. shall be factory pre-wired to control panel for a one point connection by Division 26.
 - a) Control Panel shall include circuit breakers for the following items:
 - (1) 20A, single pole breaker for lighting fixtures.
 - (2) 20A, single pole breaker for 120V, duplex receptacles, as indicated on Drawings; four (4) duplex receptacles/breaker, maximum.
 - (3) Dedicated breaker for 208V receptacle(s), if indicated on Drawings.
 - (4) Any/all auxiliary miscellaneous loads.
 - 2) Control panel shall carry the Underwriters Laboratory (UL) Listing as a final assembly.
 - 3) Control panel access and features shall be in compliance with codes and guidelines for accessibility by the disabled.
 - 4) Control Panel Location: Surface mount on outside of each room next to strike side of door, unless indicated otherwise on the Drawings.
 - 5) Console shall be 16 gauge Type 304 stainless steel with welded seams and No. 4 finish and key-locked front cover to protect controls from damage and unauthorized adjustments.
 - 6) Interior room lighting to be controlled by an external switch, mounted on the outside of the control panel with an operational pilot light.
 - 7) Controller shall be PLC with touch-screen interface and password protection. Controller shall have non-volatile memory to maintain all settings and functions in the event of a power failure without the use of batteries, and shall automatically restart upon power restoration. Plug-in components shall be used for easy replacement. Controller shall disallow inputs that are not within the operating range of the room.
 - a) All controls to be clearly identified with silk-screened or other approved permanent markings. Wiring shall be identified with permanent labels for efficient diagnosis and maintenance.
 - b) Provide manual defrost to initiate a defrost cycle on demand for testing, servicing, or as needed, through touch screen interface.

- c) Overcurrent protection shall be provided at single point power connection in the control panel for all the major power utilization equipment.
 - d) Label/Listing: Assembled control panel shall be labeled or listed by a certified national testing laboratory, such as ETL, UL or MET.
 - e) Controller shall allow user selection for temperature display in Celsius or Fahrenheit degrees.
 - f) Controller shall have lockable keypad with security code.
 - g) Controller shall offer user-definable alarm options. Controller shall have two-stage alarm outputs for alert and shutdown.
 - h) Temperature: Temperature control shall be through PLC with RTD sensing. Sensor sensitivity shall not be less than 0.01degree C over the entire range of the chamber. Sensor shall be located to detect the average temperature within the chamber. The chamber temperature set point shall be set through the digital control and LED read out shall be in 0.1 degree C increments. Controller shall display chamber set point and actual chamber temperature. Controller shall retransmit an industry standard output signal (4-20ma) for remote monitoring of room temperature specified under Division 25.
- 8) Temperature Limit Controls (Controlled Temperature Rooms): High and low limit controls shall be provided to allow presetting of high and low temperature limits. In operation, the controls would shut off the power to the Controlled Environment Room and to the refrigeration system, if preset limits were achieved. Warning light shall illuminate on the control panel and an audible alarm sounded in case of safety cutoff. Calibrate set point dial in degrees C and percent RH. Audible signal shall be deactivated by manual contact pushbutton. Warning light shall be deactivated when system returns to normal conditions.
- 9) Alarm System and Recorders:
- a) Recorder System:
 - (1) Controlled Temperature Room: Provide paperless chart recorder with 10.4 inch (264 mm) color display. Recorder shall display 7 day temperature data, calibrated in degrees Celsius. Data shall be stored on disk. Recorder shall be mounted in each room's control console. Include recorder software to permit programming of chart configuration and parameters. Honeywell Circitrend V5, or equal; substitutions are permitted subject to Section 01 63 00.
 - b) Personnel Emergency Alarm: Each room shall be provided with reset-type, electrically-powered personnel emergency alarm system; power shall be provided by the room electrical input and pre-wired to the control panel. The system shall consist of an actuator within the room, and audible and visual alarms affixed to the front exterior of the room. Alarm shall be silenced only by deactivating the switch inside the chamber.
 - (1) The alarm system actuator shall be a heavy duty, oil-tight switch, equipped with a red button marked, "EMERGENCY ALARM - PULL TO RESET." The actuator shall be mounted on the interior wall of the room adjacent to the doorjamb at 12 inches and 50 inches (305 mm and 1271 mm) above the floor level. Emergency alarm switch shall be lighted.
 - (2) The audible alarm shall be of a type that provides a high decibel level of sound output at a frequency distinct from room parameter alarms. The visual alarm shall be mounted in an area providing no vision interference and shall be prominently labeled "PERSONNEL EMERGENCY."
 - (3) Provide a set of dry contacts for local alarm.
 - (4) Provide a set of dry contacts for connection to the building automation/ management system specified under Division 25.
6. Environmental Conditioning System: Evaporator coil and heater assembly shall be installed within this positive pressure plenum, allowing conditioned air to be diffused through the suspended ceiling panels uniformly into the room. All air handling equipment, consisting of blowers, evaporator coils, heaters, valves and drain pans, shall be housed in a modular enclosure(s) suspended from the room ceiling within the positive pressure plenum. Evaporator fan motors shall either be electronically commutated or of equivalent efficiency. Air handling equipment shall be factory pre-wired to the control panel.
- 1) Ventilation:
- a) Controlled Temperature and Controlled Environment Rooms: Furnish each room with:

- (1) Provide forced air exchange ventilation system for application consisting of an independent exhaust blower and adjustable intake filter port. Intake filter shall be easily accessible and replaceable.
 - (2) Air exchange shall provide make-up air from the laboratory space at the rate of 0.25 CFM per square foot (0.425 m³/h per square meter), or as indicated in the Controlled Environmental Room Schedule.
- 2) Refrigeration System:
- a) General: The refrigeration system shall use refrigerants acceptable to the Authority Having Jurisdiction. No CFC type refrigerant shall be acceptable. Refrigeration system shall be provided with replaceable suction line filters and isolation valves as an integral part of the Controlled Environment Room conditioning system. Each system shall be designed and furnished in such a manner as to allow the motor compressor to operate continuously with a bypass system to maintain specified temperature ranges.
 - b) For sizing purposes, each system shall be capable of removing not less than 7 Watts of live load per square foot (23 W of live load per square meter) of floor space.
 - c) System shall incorporate an automatic defrost system for any room operating below 5 degrees C. Defrost system shall incorporate heaters to prevent condensate pan or drain line freezing. Automatic bypass of the defrost cycle shall be provided for use when room is operated above 5 degrees C. There may be a nominal temperature rise allowed during the defrost cycle. Automatic defrost system shall be factory pre-wired to the control panel.
 - d) Piping:
 - (1) All refrigeration piping required shall be seamless copper tubing, Type L ACR, and shall be furnished and installed by the Controlled Environment Room manufacturer. Fittings shall be wrought copper fittings. Provide vibration isolation, as required, for refrigeration piping.
 - (2) Condensate drain lines shall be 7/8 inch (22 mm) OD copper or CPVC tubing. Provide cleanout tee near evaporator and adequately pitch piping toward floor drain or sink. On rooms operating at or below 0 degrees C, drain lines shall be wrapped with heating cable and covered with insulation. The cable shall heat continuously below 0 degrees C.
 - (3) Condensing unit water shall be piped in Type L copper with wrought copper fittings, or black steel with malleable iron fittings.
 - (4) Silver solder shall be used for all copper pipe joints.
 - (5) All piping shall be pressure leak tested and witnessed by the Laboratory. Start up shall require replacement of all filters prior to turning equipment over to the Laboratory.
 - (6) Piping shall not be installed in construction sleeves with electrical conduit and/or circuitry.
 - e) Pipe Insulation: Closed cell, flexible foam: Armaflex, or equal. Substitutions are permitted subject to Section 01 63 00. Minimum insulation thickness shall be 1/2 inch (13 mm), except for rooms operating at 0 degrees C or below, where the minimum thickness shall be 3/4 inch (19 mm). Insulation shall be in compliance with flame spread and smoke development requirements. Wherever the insulation terminates, the edges shall be sealed to the pipe with sealant.
 - f) Compressor-Condensing Unit: Compressor of appropriate size and type to achieve and maintain the individual room operating temperature requirements, and must be sized to handle the additional heat loads of any equipment shown on the Laboratory Furnishing drawings. Compressor-condensing unit to be complete in all respects, including spring isolator mounts, high/low pressure safety control with automatic reset, receiver with fusible plug, liquid line drier with sight glass, crankcase pressure regulator, vibration absorbers, thermal protection, expansion valves and all necessary equipment to achieve cited performance. Manufacturer shall determine horsepower. Condenser fan motors under one (1) horsepower shall be either electronically commutated or other motor types with equivalent efficiency, permanent split capacitor-type motors, or polyphase motors larger than one-half (1/2) horsepower. Install all piping and tubing required.
 - (1) Controls, solenoids, and any other valves shall be non-proprietary.

- (2) Refrigeration system shall use hot gas bypass regulator to idle the compressor when the temperature is satisfied. The compressor shall use an automatic de-superheating valve to maintain safe compressor discharge temperatures. Provide isolation valves on inlet and outlet. All valves for refrigerant shall be rated for this application. All valves and controls shall be located in serviceable locations and permit replacement of core without shutting down system.
 - (3) System capacity shall be sufficient to simultaneously and continuously satisfy all loads, from 0 to 100 percent, including heat transmission from external sources, ventilation load, and internal heat gain from equipment, lighting, and people.
 - (4) Refrigerant: Manufacturer shall select refrigerant to give optimum operation considering evaporating and condensing temperatures. Refrigerant shall be CFC- and HCFC-free. Refrigerant shall conform to latest protocol concerning its use based on ozone depletion potential. Selected refrigerant shall not be scheduled to be phased out.
- g) Condenser shall be water-cooled with process cooling water.
- (1) Cooling water shall be modulated by a manual two- or three-way modulating water valve, unless the manufacturer recommends and automatic valve. Valve shall be direct acting with adjustable opening point. Valve body shall be cast brass with aluminum bronze seats, brass extension sleeve and disc holder, and be suitable for a water pressure of 150 psi (1.03 MPa) at 170 degrees F (77 degrees C). Valve shall be supplied and installed by room manufacturer. The total pressure drop through the condenser, control valve and associated valving at design flow shall not exceed 10 psi (69 kPa). Temperature differential shall be a maximum of 25 degrees F (14 degrees C)
 - (2) Submit for review a schedule indicating for each room: design flow of cooling water, control valve size, factory set points, and water pressure drop through the condenser and associated valving.
 - (3) The compressor/condensing unit assembly is to be mounted on top of the Controlled Environment Room. Coordinate condenser placement on top of room insulated ceiling panels near door or, if not possible, with location of ceiling access panel. Mount vibrating assemblies on spring isolators. Evaporator shall be copper tube with aluminum fins.
 - (4) Cooling water source is from the process cooling water system with a supply temperature of 56 degree F to 60 degree F.
- h) Dehumidification:
- (1) Provide specially designed direct expansion refrigerated dehumidification coil as integral part of evaporator plenum. Dedicated coil shall remove condensate to double wall stainless steel drain pan system. Dehumidification coils shall have valving to achieve the temperatures necessary to maintain the specified relative humidity levels.
 - 3) Automatic Defrost: Provide integrated, automatic defrost for the evaporator coil. Set defrost initiation time and duration so that room temperature increase is minimized while achieving complete removal of accumulated frost. After defrosting, evaporator shall be pre-cooled prior to re-starting of fans. All humidification equipment shall be disabled during defrost cycle. For freezer rooms operating at -20 degrees C or below, an electric defrost system may be used in lieu of hot gas system.
 - 4) Variable Heat Control: When electrical heaters are used to maintain Controlled Environment Room conditions, they shall be controlled by SCR control, only, so that system is variable from 0 percent to 100 percent.
7. Control and Performance Parameters:
- 1) Controlled Environment Room temperature and humidity ranges are listed in the Drawings and Specifications.
 - 2) Temperature and humidity uniformity, the temperature and humidity ranges indicated on the Drawings, shall be measured across the room, horizontally and vertically, to a point 12 inches from the panels.
 - 3) The sensitivity of the temperature control shall be ± 0.2 degrees C or less.
 - 4) Controlled Temperature Rooms: Humidity shall be maintained at a level to avoid condensation on room surfaces under operating conditions.
8. Electrical:
- 1) Electrical work shall be in accordance with Division 26 specifications, unless noted otherwise herein.

- 2) All electrical components utilized within each Controlled Environment Room shall be U.L. Listed or recognized with interior wiring practices in accordance with Underwriters Laboratories and the National Electrical Code. Conductors to conform to Article 310 of the N.E.C. and all motors, motor circuits and controllers to conform to Article 430 of the N.E.C. Required electric power is shown on the Electrical drawings.
- 3) Work performed under Division 26 shall make complete power service connection to each condensing unit and Controlled Environment Room control panel, shall provide power wiring and conduit to these two points, only, and shall furnish and install an individual fused disconnect switch for each condensing unit.
- 4) Electrical conduit and circuitry shall not be installed in construction sleeves with piping.
- 5) Manufacturer shall provide room entirely waterproof, pre-wired, with all receptacles, lighting, and 120V, 208V, if required, and low voltage control circuits installed. Conduit shall be a minimum of 3/4 inch (19 mm) diameter.
- 6) All electrical receptacles shown on the Electrical drawings shall be recessed into insulated wall panels, foamed-in-place, vapor-proof, corrosion-resistant, with weatherproof aluminum covers. Receptacles shall be GFCI-type. Receptacles shall be mounted at 45 inches above finished Controlled Environment Room floor, unless noted otherwise.
- 7) The room shall require power connections as follows, each with a dedicated circuit breaker. Manufacturer shall coordinate power requirements for actual intended equipment with Contractor prior to submittal.
 - a) Control Panel: 208 Volt/3 phase/4 wire plus ground. Control wiring and conduit between the control panel and the condensing unit shall be by the manufacturer. All miscellaneous loads shall be supported from the control panel.
 - b) Condensing Unit: 480 Volt/3 phase/3 wire plus ground.
9. Lighting:
 - 1) Lighting fixtures shall utilize 48 inch (1219 mm) T8 3500 K, 85 CRI fluorescent lamps. High output lamps and low temperature ballasts may be used in rooms that operate below 10 degrees C. Provide fully-gasketed, prismatic lens, U.L. listed fixtures with wet location label rated to operate at temperatures as low as -20 degrees C. Provide vapor-proof incandescent lights in rooms designed to operate at or below -20 degrees C. Fixture construction, ballast, lamps, and lens shall comply with Section 26 51 00 requirements.
 - 2) Light fixtures shall be mounted above diffusion grating in ceiling plenum in sufficient quantity to achieve an average maintained illumination level of 70 foot-candles (753 lux) at 36 inches (914 mm) above the room finished floor at the operating temperature of the room, or range of operating temperatures.
 - 3) Lighting shall be furnished, installed and pre-wired to switch mounted on the control panel.
10. Plumbing: The room manufacturer shall provide all plumbing work inside the Controlled Environment Room. Work performed under Division 22 shall make final connection from Controlled Environment Room condensate drain connection to sink trap drain or other drain outside the room as shown on Plumbing plans. Hot water piping, if provided, shall be insulated.
11. Fire Protection: Dry pendant sprinkler heads provided under Division 21. Sprinklers shall not be provided in freezers. Manufacturer shall coordinate sprinkler piping and installation, and prepare penetrations through panels, prior to sprinkler piping installation to avoid conflicts with Controlled Environment Room equipment. Sprinkler heads and drop shall be installed after installation of controlled environment room equipment. Sprinkler installer shall seal penetrations inside and outside of the box.

3.3 ASSOCIATED COMPONENTS AND SYSTEMS

- A. All other products, including closure trim pieces and angles necessary for complete installation and operation shall be subject to the review of the Laboratory. Closure pieces shall match exterior panel finish, unless indicated otherwise on Drawings.

PART 3 - EXECUTION

4.1 SITE CONDITIONS

- A. Inspection: Prior to installation of Controlled Environment Rooms, 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.
1. Verify that Work can be installed in strict accordance with all pertinent codes and regulations, the original design, approved submittals, and manufacturers' recommendations.
 2. Discrepancies: In the event of discrepancy, immediately notify the Laboratory.

4.2 INSTALLATION

- A. General: Install all room and chamber assemblies in accordance with referenced standards, manufacturers printed instructions and approved submittals.
1. Install all panels, components, controls, systems and accessories necessary to provide complete functional assembly.
 2. Recessed floor panels, where specified, shall be installed on a level bed of dry sand, not to exceed 1/4 inch (6 mm). Coordinate depth depression with Division 03 installer so that finished floor of controlled environment room is flush with building finished floor.
 3. Furnish and install the necessary vertical and horizontal closure panels and strips to enclose opening between Controlled Environment Room and adjacent corridor, building partitions, and ceiling. Finish shall match room exterior, unless specified otherwise.
 4. All service line penetrations into room shall be properly sealed with silicone sealant.
 5. Run condensate piping to nearest sink or drain as shown Drawings.
 6. All conduits shall be plugged with sealant at the point where they open to ambient air to prevent moisture infiltration and condensation discharge into the room. Sealant plugs shall be capable of easy removal and replacement during rewiring.
 7. All panels shall be installed without distortion, properly aligned and flush.
 8. Coordinate slab or deck depression with the work of Division 03.

4.3 TESTING

- A. Provide all equipment and instrumentation for testing and perform the specified tests for each room.
1. Witnessing of Tests: Laboratory and Architect shall be given the option of witnessing factory and field tests and confirming results. Notify Laboratory and Architect, in writing, 10 days prior to tests.
 2. Factory Testing:
 - 1) Each control panel shall be factory tested using simulator panel to test logic functions, control systems functions, and alarm operations.
- B. Field Testing:
- 1) Each condensing unit and air unit shall be pressure tested for leaks and checked for design conformance.
 - 2) Uniformity Testing:
 - a. Temperature uniformity, the temperature range identified on the Drawings, refers to the temperature variation within the room as measured to a point 12 inches (305 mm) from the walls, ceiling or floors. Uniformity shall be measured by randomly hanging 12 thermocouples throughout the control zone space and recording the readings on a multi-point strip chart recorder for at least 24 hours per room. Fixed temperature rooms shall be tested at the specified temperature. Variable temperature rooms shall be tested for 24 hours, each, at the minimum temperature, the maximum temperature, and one intermediate temperature specified. Verify that maximum temperature range from floor-to-ceiling and wall-to-wall does not exceed the range indicated on the Drawings.
 - 3) Recovery Test: All rooms, except freezers, shall recover preset operating temperature within three (3) minutes after door has been fully opened to 75 degrees F (24 degrees C) ambient for a period of fifteen (15) seconds.
 - 4) Test panic alarm button and controller output signals for each room to confirm signals are received at monitoring system.
 - 5) Adjust and re-test all rooms not meeting specified requirements until requirements are achieved.
- C. Certification and Testing:

- 1) Certification and test results shall be provided prior to, and are a requirement for, Substantial Completion.
- 2) Provide written reports of all tests. Reports shall indicate room, procedures followed, instruments used, quantity of tests and re-tests, test personnel and witnesses, and tabulation of results, including the following:
 - a. Provide written certification that the room performance complies with specified criteria, equipment is installed in accordance with applicable codes and standards, adjusted and ready for intended function.
 - b. Recorder charts shall be transmitted to Laboratory with copy to Architect.
 - c. Instrumentation calibration reports.

END OF SECTION

SECTION 13 49 57

LABORATORY RADIO FREQUENCY SHIELDING ENCLOSURE (Revised AD-4)

PART 1 - GENERAL

1.1 SUMMARY

AD-4:

- A. Design, engineer, fabricate, install and test radio frequency (RF) shielded laboratories that will provide at least 100dB of RF isolation up to 2.5GHz. Shielding will be constructed of fully annealed pure copper, **or other appropriate performing material**, for laboratory rooms A027, A029, and B031 as indicated on the drawings.
 - 1. Include single knife-edge RF doors
 - 2. Include penetration treatments (waveguide below cutoff) for all required piped-in gases
 - 3. Include penetration treatments for plumbing
 - 4. Include penetration treatments for RF power filters
 - 5. Include honeycomb HVAC filters
- B. Coordinate design of RF shielding with drawings and end-user stated requirements.
- C. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. Standards:
 - 1. MIL-STD-285 - Methods of Attenuation Measurements for Electromagnetic Shielding Enclosures for Electrical Test Purposes.
 - 2. MIL-STD-220-A - Methods of Insertion Loss Measurements for Radio Frequency Power Line Filters.
 - 3. IEEE 299 (2006) Standard Method for Measuring the Effectiveness of Electromagnetic Shielding Enclosures
 - 4. ASTM Standards:
 - a. ASTM-E84, "Surface Burning Characteristics".
 - b. ASTM-F1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride".
 - c. ASTM-E90 and STM-E413, "Acoustic Performance".

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Engaged in manufacture and installation of RF-shielded enclosures of like size and complexity of that required for this Project for a period of not less than 8 years.
 - 2. Directly employ experienced and properly equipped engineering, drafting, and project management departments.
- B. Use of Dissimilar Metals
 - 1. Do not place dissimilar metals in direct contact without appropriate protection.
 - a. RF shielding medium shall display an anodic voltage differential index of less than 0.40 Volts and a cathodic group number of 1 to 9 (0.00 to 0.40 Volts).
 - b. Construct shielding system with proper materials so that ionic conduction across joints and RF seams shall be less than 0.10 Volts.
 - 2. Bronze or brass flame sprayed treatments of steel or aluminum RF contact surfaces are acceptable

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Include typical floor plan of space, enclosure elevations, typical construction, sections, and locations of RF shielded penetrations.
 - 2. Details.
- B. Product Data:
 - 1. Test Data: Door system life cycle test. Provide separate test report to the architect or owners agent when requested for review.
- C. Contract Closeout Information:
 - 1. Test Reports.
 - a. Qualification Test.
 - b. Acceptance Test.
 - c. Ground Isolation monitoring Test.
 - 2. Warranties.

1.5 WARRANTY

- A. Warrant the system to be free of defects in materials and workmanship as evidenced by retention of specified RF shielding characteristics for periods as follows:
 - 1. Basic Enclosure: 5 years.
 - 2. EMI Electrical Filters, RF Shielded Doors, RF Shielded Windows, Pipe Penetrations, and Air Vent RF Filters: 1 year.
- B. Pass-through warranties provided by subcontractors to manufacturer shall not be allowed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Radio Frequency Shielding:
 - 1. Base:
 - a. ETS-Lindgren, Inc.
 - b. Global Partners in Shielding
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS COMPRISING THE RF SHIELDING SYSTEM INSTALLATION

- A. Shielding Material:
 - 1. Annealed pure copper with a conductivity rating of 1 or greater, and conforming to the galvanic requirements specified.

AD-4:

- B. RF Shielded Floor System:
 - 1. General:
 - a. Provide copper, monolithic, RF floor membrane, or other appropriate material to meet the shielding requirements and laboratory environment.
 - b. RF solder weld copper membrane seams, if copper is used.
 - c. Provide electrical isolation of enclosure and RF floor system by use of a two-part, thermosetting resin applied directly to concrete floor substrate.
 - 1) Use of Masonite, other pressed wood materials, plastic sheet or other sheet goods for electrical isolation or as a moisture barrier is not permitted.
 - d. Where substrate is in direct contact with soil (slab-on-grade): Refer to Part 3 for limitations on substrate vapor pressure.
 - 2. Water Resistance:

- a. No porous products (including wood particleboards, plywood, wafer board, Masonite or other pressed paper products, etc.) utilized within the flooring system.
- b. RF floor assembly must resist fluid ingestion from any fluid source within the RF enclosure and any fluid source originating outside of the RF enclosure.
- c. Install cementitious grout underlayment where required.
- d. Install structural concrete topping slabs where required.

AD-4:

- 3. Floor panels:
 - a. Constructed of pure copper, or other appropriate RF shielding medium of appropriate gauge, thickness and shielding material to meet performance requirements .
- 4. Membrane Adhesive:
 - a. Bond monolithic copper membrane to dielectric barrier with a two part adhesive resin compatible with both the copper and dielectric barrier.
- 5. Epoxy Grout Coating:
 - a. Over-coat copper membrane with a chemically cured epoxy grout.
 - b. Install grout underlayment to a minimum 1/2 IN thickness over entire laboratory surface.
 - c. Grout coating shall not delaminate.
- C. Primary Shielding:
 - 1. Vertical Walls and Ceiling:
 - a. Integral with RF floor system.

AD-4:

- b. Fire retardant treated wood frame construction wrapped on three sides of each individual frame with pure copper RF sheet, if copper is the selected shielding material.
- c. Bolt RF panels together to provide continuous, constant, and uniform RF seams.
 - 1) Fasteners:
 - a) Material: Non-oxidizing.
 - b) Minimum Spacing: 8 IN centers.
 - 2) RF seams constructed by the use of mechanical fasteners such as conductive tape, nails, staples, or other penetrating devices are forbidden.
- d. Wood Frames:
 - 1) 1-3/4 IN thick LVL or Microlam engineered wood members.
- e. Support Frame Fire Treatment and fastener type and location:
 - 1) Treat RF support frames with a fire treatment process that meets the following ASTM and NFPA Standards:
 - a) ASTM-D1413, D3201, D3345, D5516, D5664, E84 and E162.
 - b) NFPA– 255, 258, & 259.
- D. RF-shielded Door Assembly:
 - 1. General:

AD-4:

- a. Door leaves, frames and Hardware: High-performance, single knife-edge or other design, with performance exceeding 100dB up to 2.5GHz.
- b. RF Performance:
 - 1) Utilize a proven RF seal design that is easily maintained and serviced.
 - 2) Maintain a shielding effectiveness equal to that of shielded enclosure.
- c. Life cycle test rating:
 - 1) Minimum 10,000 operational cycles without loss of specified RF attenuation.
 - 2) Minimum 50,000 cycles with planned maintenance without loss of specified RF attenuation.
- 2. Frame:
 - a. Pre-finished.
 - b. Manufacturer's standard.
- 3. Door:

- a. Finish as desired by end user
 - 4. Threshold:
 - a. Manufacturer's standard.
 - 5. Hardware:
 - a. General:
 - 1) Door shall employ fail-safe unlatching; Upon loss power the door will revert to an unsealed condition.
 - 2) Remote activation/deactivation capabilities.
 - 3) Cylinders (Specified in Section 08 71 00) and keyed to building system.
 - 4) Finish: 626 or matching Hardware specified in Section 08 71 00.
 - 6. Interlock switch mechanism: Manufacture's Standard.
 - 7. Retractable RF sealing system (if retractable sealing-type door is selected):
 - a. Consisting of a continuous monolithic strip running the full length of each edge of door.
 - 1) Monolithic strips automatically retract into the door leaf edge presenting a smooth unbroken surface upon opening the door.
 - 2) The door shall be automatically activated to a RF sealed condition when placed in the closed position by an electronic detector
- E. AD-4: Heating, Ventilation and Air Conditioning:
- 1. General:
 - a. Design RF shielded air vents to maintain a shielding effectiveness equal to that of shielded enclosure.
 - 2. Vent Type:
 - a. Wave-guide below cutoff type, 3/16 IN brass hex cells, and minimum 1 IN in thickness.
 - 3. HVAC Services feeding or entering the RF enclosure:
 - a. Specified by Mechanical Specification Divisions, and installed by mechanical installer.
 AD-4:
- F. Mechanical Pipe Penetrations:
- 1. Wave-guide below cutoff type, not to exceed 1.25 inches in inner diameter, and at least 6 inches in length.
 - 2. Construct pipe penetrations of a material suitable to conditions of service on which it is installed, and to maintain shielding effectiveness equal to that of the shielded enclosure (100dB up to 2.5GHz).
 - 3. Mechanical Piping Services feeding or entering the RF enclosure:
 - a. Specified by Mechanical Specification Divisions, and installed by mechanical installer.
 - b. Notify installer of RF suppliers approved techniques.
- G. EMI Rated Power Line and Signal Electrical Filters:
- 1. General:
 - 2. RF-shielded electrical filters:
 - a. Insertion loss as specified within MIL-STD 220-A and maintain the shielding effectiveness equal to that of the shielded enclosure (100dB up to 2.5GHz).
 - b. Provide an EMI filter for each electrical conductor (including power, data, fire protection, security, or any other) that penetrates the enclosure, including neutral conductors.
 - c. UL certification will be required for power line filters.
 - 3. Refer to Electrical Drawings for indication of specific electrical characteristics of and the total number of conductors required for lighting and power circuits, communication devices, environmental control devices, data transmission devices, and fire alarm devices that will be utilized within the RF enclosure.
 - 4. Electrical Services feeding or entering the RF enclosure:
 - a. Specified by Electrical Specification Divisions, and installed by electrical installer.
 - b. Notify installer of RF suppliers approved techniques.
- H. Grounding Conductor Terminal:
- 1. Provide a single point ground conductor terminal using a brass stud and copper bus bar, common to both interior and exterior of enclosure.

- a. Locate terminal as close as possible to the penetration panel and to EMI power line filters.
- 2. Ground Conductors feeding or entering the RF enclosure:
 - a. Specified by Electrical Specification Divisions, and installed by electrical installer.
 - b. Notify installer of RF suppliers approved techniques.
- I. Acoustical Ceiling Tiles:
 - 1. Specified in Section 09 51 00.
- J. Interior Painting:
 - 1. Specified in Section 09 91 23.
- K. Other finishes: Specified in Division 09 as applicable.
- L. Suspension System as required to support RF ceiling panels:
 - 1. Modular Steel Channels and hangers (a.k.a. "Unistrut"): Specified in Section 05 45 23.
 - 2. Nominally 4 FT on center at an elevation not more than 2 FT above the enclosure.
 - 3. Final design, location and spacing as directed by designer RF Enclosure.
 - 4. Design to support weight of RF Ceiling panels and finished ceiling.
- M. Related Mechanical and Plumbing items:
 - 1. Specified in Mechanical Specification Divisions:
 - a. Connections of ductwork to wave-guides:
 - b. Dielectric connections to the exterior side of each mechanical pipe penetration of a suitable material to maintain a minimum of 1,000 Ohms DC resistance to earth ground, construct of material suitable to conditions of service on which it is installed.
 - c. Pipe connections to or from the installed wave guide beyond cutoff pipe penetration.
- N. Related Electrical items:
 - 1. Specified in Electrical Specification Divisions:
 - a. Electrical connection to the installed RF power and/or signal filters, either internally or externally to the enclosure.

2.3 PERFORMANCE

- A. Design and Install RF enclosure assemblies which provide functional EMI attenuation to decibel ratings as follows:

EMI Attenuation Ratings		
Category	Frequency range	Decibel rating:
Plane Wave	10MHz – 2.5GHz.	100db.

- B. Construct installed enclosure so that, without connections to earthing terminal, ohmic value of enclosure relative to earth ground shall be equal to or greater than 1,000 Ohms.

2.4 JOB CONDITIONS

- A. Construction Facilities and Temporary Controls and Utilities: Specified in Section 01 50 00.
- B. Maintain installation site at a minimum of 68 DegF for a period of 24 hours prior to, during, and after enclosure installation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Substrate Quality Requirements:
 - 1. Notify slab installer of the physical requirements of the substrate in time for incorporating into work including but not limited to:

- a. Level within 1/4 IN in any 10 FT section.
- b. Concrete allowed to cured for minimum 7 days prior to start of enclosure installation.
- c. Maximum allowable water vapor transmission through the substrate determined to receive epoxy coatings is 3 LBS per ASTM-F1869.
 - 1) Where slabs exceed the above value, delay installation of flooring until equilibrium <3 LBS is reached OR stabilize vapor pressure with topical treatment system specified in Section 09 60 05.
- B. Ensure that installation site has been properly weatherproofed.
 - 1. Protect Laboratory Rooms from moisture, standing water, and running water prior to, during, and following enclosure installation to ensure enclosure integrity and specified earth ground isolation.
- C. Field verify dimensions and prepare Shop Drawings based on actual values.

3.2 INSTALLATION

- A. Assemble enclosure wall and ceiling RF panels into straight, level and plumb surfaces.
 - 1. Align and secure RF joints.
- B. Perform installation by system manufacturer, or under manufacturer's direct supervision.
- C. Install per approved Shop Drawings.
- D. Coordinate installation of RF enclosure with installation of other trades

3.3 TESTING

- A. Test enclosure in accordance with MIL-STD-285, and IEEE-299.
- B. Qualification Testing:
 - 1. Perform immediately after completion of the enclosure and prior to installation of architectural surfaces within or outside the enclosure.
 - 2. Make no trade connections to enclosure until successful completion of test process.
 - 3. Witness: Notify Owner's Representative, and Contractor/Construction Manager, in advance, of on-site testing.
 - 4. Furnish a written test reports to affected parties.
- C. Acceptance Testing:
 - 1. Perform immediately after installation of the Laboratory equipment
 - 2. Witness: Notify Owner's Representative, and Contractor/Construction Manager, in advance, of on-site testing.
 - 3. Furnish a written test reports to affected parties.
- D. Ground Isolation Monitoring:
 - 1. Monitor ground isolation during entire phase of construction for a minimum of 1,000 Ohms above earth potential.
 - a. Immediately correct deficiencies.
 - 2. Provide an adjustable audio and visual ground isolation device for continuous monitoring of the RF enclosures ground isolation.
 - a. Device is to remain with the enclosure for follow up monitoring by the Contractor/Construction Manager.
 - 3. Furnish a written test reports to affected parties.

END OF SECTION

SECTION 14 21 43
GEARED TRACTION ELEVATORS - SERVICE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Geared Traction Elevators – Service, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Optional manufacturers are responsible for, at no additional cost to Laboratory:
 - 1. Costs for dimensional adjustments to fit their elevators to openings.
 - 2. Hoistway inside dimensions or floor to floor heights shall not be changed.
 - 3. Provide or arrange for additional electrical wiring, energy, panels, transformers etc., required to accommodate their elevators.
- B. Applicable Codes and Standards:
 - 1. Comply with Building Codes and Elevator Codes as locally adopted and amended, including but not limited to the following:
 - a. ANSI A117.1, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
 - b. ADAAG, Americans with Disabilities Act Accessibility Guidelines.
 - c. Operation and installation standards in conformance with ADA Accessibility Guidelines; 28, CFR, Part 36.
 - d. ANSI/NFPA 70, National Electrical Code.
 - e. ANSI/NFPA 80, Fire Doors and Windows.
 - f. ANSI/UL 10B, Fire Tests of Door Assemblies.
 - g. ASME/ANSI A17.1, Safety Code for Elevators and Escalators:
 - 1) 2007 edition..
 - h. Building Code:
 - 1) 2009 International Building Code.
 - i. All other local applicable codes.
- C. Seismic Design Parameters:
 - 1. Design and install equipment complying with seismic requirements of Building Code listed above.
- D. Manufacturer Qualifications:
 - 1. Provide elevators manufactured by a firm with a minimum of 10 years experience in fabrication of elevators equivalent to those specified.
- E. Installer Qualifications:
 - 1. Installed by the manufacturer.
 - 2. Permits and Inspections: Provide licenses and permits and perform required inspections and tests.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Hoistway Plans and Machine Room Plans and Sections clearly showing the following:
 - a. Structural Loads imposed on building superstructure.
 - b. Clearances and travel of car.
 - c. Hoistway and pit dimensions.

- d. Location and sizes of access doors, hoistway entrances and frames.
 - e. Car, guide rails, buffers and other components in hoistway.
 - f. Signal and operating fixtures, operating panels and indicators.
 - g. Cab design, dimensions and layout.
 - h. Hoistway-door and frame details.
 - i. Electrical characteristics and connection requirements.
 - j. Heat dissipation (BTU) of elevator equipment.
- B. Product data.
 - C. Samples:
 - 1. Cab and entrance finishes.
 - D. Contract Closeout Information:
 - 1. Operating and maintenance data.
 - 2. Owner instruction report.
 - 3. Warranty.

1.4 WARRANTY

- A. 1-year from Substantial Completion including 1-year Service Contract.
- B. Service Contract:
 - 1. Service frequency: Monthly.
 - 2. Include examination, oiling, greasing, adjustment and repairs as required.
 - 3. Normal work hour service.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Electric traction elevators (or machine room-less elevators):
 - 1. Base:
 - a. Otis Elevator
 - b. ThyssenKrupp.
 - 2. Optional:
 - a. Kone.
 - b. Schindler Elevator.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 GENERAL PARAMETERS – ELEVATOR #1

- A. Elevator operating equipment - General:
 - 1. Machine: Geared Electric Traction (or Machine Room-Less).
 - 2. Machine Location: Overhead.
- B. Cab Dimensions (inside clear):
 - 1. Minimum width: 5 FT-8 IN.
 - 2. Minimum depth: 8 FT-6 IN.
 - 3. Minimum area: 47 SF.
- C. Capacity Rating:
 - 1. 5,000 LBS minimum (or greater if required to comply with applicable code).
- D. Cab Height:
 - 1. Extended-height Cabs: 115 IN gross; 106IN clear (under finished ceiling).
- F. Speed:
 - 1. 200 FPM.
- G. Travel: 48 FT-0 IN.

- H. Number of Stops: 4 stops.
- I. Hoistway Entrances - General:
 - 1. Quantity (per each elevator):
 - a. Front: 4.
 - b. Rear: None.
 - 2. Door Type:
 - a. 2-speed, opening to the side.
 - 3. Door Opening Width (clear):
 - a. 54 IN
 - 4. Door Height (clear):
 - a. 96 IN minimum.
- J. Base Product:
 - 1. "Model: Gen2 5000H" by Otis Elevator with modifications indicated.
 - 2. "Model: SPF-50" by ThyssenKrupp Elevator with modifications indicated.

2.3 GENERAL PARAMETERS – ELEVATOR #2

- A. Elevator operating equipment - General:
 - 1. Machine: Geared Electric Traction.
 - 2. Machine Location: Overhead.
- B. Cab Dimensions (inside clear):
 - 1. Width: 6 FT-8 IN.
 - 2. Depth: 14 FT-0 IN.
 - 3. Area: 93 SF.
- C. Capacity Rating:
 - 1. 9,000 LBS minimum (or greater if required to comply with applicable code).
- D. Cab Height:
 - 1. Extended-height Cabs: 111 IN gross; 104 IN clear (under finished ceiling).
- F. Speed:
 - 1. 200 FPM.
- G. Travel: 64 FT-0 IN.
- H. Number of Stops: 5 stops.
- I. Hoistway Entrances - General:
 - 1. Quantity (per each elevator):
 - a. Front: 5.
 - b. Rear: None.
 - 2. Door Type:
 - a. 2-speed, opening to the side.
 - 3. Door Opening Width (clear):
 - a. 60 IN.
 - 4. Door Height (clear):
 - a. 96 IN minimum.
- J. Express Priority Service (Cryogen Hazard Service)
- K. Base Product: Custom engineered service elevator.

2.4 MACHINE ROOM EQUIPMENT

- A. General:
 - 1. Main Power Supply: 460 volts, 3 Phase, 60 Hz, with separate equipment grounding conductor.
 - 2. Car Lighting Power Supply: 120 VAC, 1 Phase, 15 Amp, 60 Hz.
 - 3. Speed: $\pm 2\%$ of specified speed under any loading condition or direction of travel.

4. Stopping Accuracy: $\pm 1/4$ IN under any loading condition or direction of travel.
 5. Electrical work: Provide necessary wiring to connect parts of equipment.
- B. Machine, machine room:
1. Geared traction type, AC motor, brake and driving sheave mounted on a rigid bedplate.
 2. Large diameter, forged shaft shall serve as a support for the motor armature and for the removable drive sheave and brake drum/disc. Support by roller bearings.
 3. Steel deflector sheaves of adequate diameter and strength provided as necessary.
 4. Sound isolation: To reduce vibration and noise transmission to the building structure.
- C. Machine, machine roomless:
1. Compact gearless type, AC motor, brake and driving sheave mounted on a rigid bedplate.
 2. Large diameter, forged shaft shall serve as a support for the motor armature and for the removable drive sheave and brake drum/disc. Support by roller bearings.
 3. Steel deflector sheaves of adequate diameter and strength provided as necessary.
 4. Sound isolation: To reduce vibration and noise transmission to the building structure.
- D. Drive:
1. Variable Voltage Variable Frequency (VVVF) AC drive.
 - a. Non-regenerative (for geared traction).
 - b. Non-regenerative, or regenerative (for machine room-less).
- E. Governor:
1. Car safety: Operated by a centrifugal speed governor located at the top of the hoistway in the machine room.
- F. Controller:
1. Microcomputer based control system to perform functions of safe elevator operation.
 - a. The system shall also perform car and group operational control.

2.5 HOISTWAY EQUIPMENT

- A. Hoistway Operating Devices:
1. Emergency stop switch in the pit.
 2. Terminal stopping switches.
 3. Car positioning vanes.
- B. Buffers: Oil type for car and counterweight at the bottom limits of travel.
- C. Guide Rails:
1. Tee-section steel rails with brackets and fasteners.
 2. Use heavy-weight rail sections as required to span between structural supports indicated, OR include supplemental steel bracing/sub-frame as required.
- D. Ropes:
1. Steel hoist ropes of size and number to ensure proper wear qualities shall be used.
 2. Wedge shackles designed for use with steel ropes shall be used.
 3. Governor rope shall be 3/8 IN iron.
- E. Pit Ladders:
1. Coordinate pit ladders per ANSI/ASME-A17.1.
 2. Ladders are specified in Section 05 50 10.

2.6 HOISTWAY ENTRANCES

- A. General:
1. Fire Label: 1-1/2 HR UL "B" labels.
- B. Frames:
1. Bolted construction for complete one-piece unit assembly.
 2. Securely fastened to fixing angles mounted in the hoistway and shall be of 14 GA sheet steel.

3. Material:
 - a. Type 430 Stainless Steel (magnetic).
 - 1) Finish:
 - a) #4, Brushed Satin.
- C. Doors:
 1. Flush, 16 GA hollow metal construction with vertical internal channel reinforcements and sound deadening material.
 2. Material:
 - a. Type 304 Stainless Steel.
 - 1) Finish:
 - a) #4, Brushed Satin.
- D. Sills:
 1. Extruded aluminum with slip resistant wearing surface.
 2. Supported on steel anchors secured to floor construction.
 3. Elevator contractor to provide sill angles as required.
- E. Entrance Markings:
 1. Entrance jambs shall be marked with 4 x 4 IN plates having raised floor markings with Braille adjacent.
 - a. Markings shall be provided on both sides of the entrance.
- F. Sight Guards: Finish compatible or matching door frames.
- G. Fascia:
 1. Galvanized sheet steel shall be provided at the front of the hoistway.
 - a. Include similarly at rear of hoistway where rear openings where indicated.
 2. Include necessary supports, connections and filler pieces.

2.7 CAR - GENERAL

- A. Carframe:
 1. Fabricated from formed or structural steel members and adequately braced to support the platform and car enclosures.
 2. Roller guides: Rubber tired, spring loaded, adjustable, which engage guide rails.
- B. Carframe Safety:
 1. Integral to the carframe; Type "B", flexible guide clamp type.
- C. Elevator Car Platform:
 1. All-steel construction with welded steel frame reinforced as necessary.
 2. Floor area: Minimum 12 GA sheet steel.
 3. Fasten securely to frame and reinforcing members.
 4. Isolate platform on rubber pads supported on auxiliary steel frame fastened to car frame
 5. Threshold Material: Extruded Aluminum.
- D. Load weighing device:
 1. Mounted under the platform.
 2. Platform load weighing device set to a predetermined maximum load in car.
 3. Car bypasses hall calls when device is actuated.
- E. Exhaust Fan: Mounted on the car top.
- F. Emergency Car Lighting:
 1. Emergency power unit employing a 6 volt, sealed rechargeable battery.
 2. Purpose: To supply illumination of elevator car and alarm bell in the event of building power failure.
- G. Emergency Pulsating Siren:
 1. Mounted on top of the car and activated by Alarm button in the car operating panel.
 2. Rated sound pressure level: 80 dba @ 3 M.

- H. Provide 125 VAC, 20A, duplex receptacle with ground-fault interrupter protection connected to same circuit as car lights and fan.
- I. Provide accessibility code items.
- J. Exit Panel:
 - 1. Standard: Hinged, type, non-locking.
 - 2. Coordinate location with ceiling and lighting.

2.8 CAB TYPE

- A. Cab Series, Stainless Steel:
 - 1. Cab Wall Materials and Finishes:
 - a. 14 GA stainless steel sheet:
 - 1) Finish: #4 Satin Brushed.
 - 2. Car Top: Cold rolled steel with hinged exit.

2.9 CAB FINISHES

- A. Car Front:
 - 1. 14 GA stainless steel:
 - a. Finish: #4 Satin Brushed.
- B. Car Doors:
 - 1. Match materials and finished indicated for Hoistway Doors (above).
- C. Car Wall Paneling:
 - 1. Refer to Section 06 42 14 for material.
 - 2. Panels as indicated on drawings.
- D. Floor covering:
 - 1. As Scheduled in Section 09 06 10.
- E. Dropped Ceiling Type:
 - 1. Island Type Halogen Downlight:
 - a. Finish:
 - 1) Plastic Laminate, Color to be selected from the manufacturer's standard color chart.
 - 2) Stainless Steel, #4 Satin brushed.
- F. Metal Handrails:
 - 1. General:
 - a. Locations: 3 walls.
 - b. Mounting Height: 36 IN above cab floor, to top of handrail.
 - c. Material and finish:
 - 1) Stainless Steel, #4 Satin brushed.
 - 2. Profile:
 - a. Flat Solid Metal:
 - 1) Size: 1/4 IN x 4 IN.
- G. Bumper Rail:
 - 1. General:
 - a. Locations: 3 walls.
 - b. Mounting Height: 12 IN above cab floor, to top of bumper rail.
 - c. Material and finish:
 - 1) Stainless Steel, #4 Satin brushed.
 - 2. Flat Solid Metal:
 - a. Profile: 1/4 IN x 6 IN.
- H. Protective Pads:
 - 1. Quilted fire retardant protective pads.
 - 2. Include hooks/buttons.

2.10 FIXTURES AND DEVICES - GENERAL

- A. Car and Hall Fixtures – Design and Style:
 - 1. Traditional Fixtures:
 - a. Faceplates: Flush-mounted, with square corners.
 - 1) Material and Finish:
 - a) #4 Satin Stainless Steel.
 - b. Indicators: Digital display for floor positions; backlit for directional indication.
 - c. Buttons.
 - d. Raised and Braille markings.

2.11 FIXTURES AND DEVICES – HALLS

- A. Hall Call Stations:
 - 1. Located adjacent to hoistway entrance, combining landing buttons and key switches required for elevator operation.
 - 2. Raised markings shall be provided for each push-button.
 - 3. Configurations:
 - a. Terminal Landings: Provide single button.
 - b. Intermediate Landing, UP and DOWN button.
 - 4. At main lobby, include a keyswitch for “Car to Lobby”, integrated into Hall Call fixture.
- B. Hall Lantern and Chime:
 - 1. Directional lantern visible from the corridor, located in the hall entrance.
 - 2. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.
- C. Standby Power Cabinet:
 - 1. Manual selection of each elevator in normal operation after automatic return in standby power operation has been initiated.
 - 2. This is achieved via a strip switch inside the standby-power cabinet.
 - 3. Location: ___To be determined_____.
- D. Express Priority Service (**Cryogen Hazard Service**):
 - 1. Applicable Elevator Number(s): Elevator #2 only.
 - 2. Locate and signal light to permit elevator to respond to that landing, canceling car calls and bypassing hall calls en route.
 - 3. Incorporate keypad into common faceplate of Hall Call Station.
 - 4. Keypad Location(s):
 - a. Locate at landings at Floor Levels: All Floor Levels.

2.12 FIXTURES AND DEVICES - CAR OPERATING PANEL (COP)

- A. General: Fully integrated unit containing phone, push buttons, key switches, and message indicators for elevator operation including:
- B. Buttons:
 - 1. Individually marked with landings served, “Emergency Call”, “Door Open”, “Door Close”, and other accessories indicated or required.
 - 2. “Emergency Stop” Button.
- C. Switches:
 - 1. “Lights”, “Inspection”, “Fan”, “Independent Service”, and other accessories indicated.
- D. Car Position Indicator: Digital readout, displaying the current position of the car.
- E. Landing Passing Signal: Chime which sounds in the car to notify passenger that the car is either stopping at or passing a floor served by the elevator.
- F. Independent Service: When switch in car is actuated, car operates independently from car buttons only and hall calls are ignored.

- G. Telephone Cabinet:
 - 1. Cover made of same material as wall it is mounted in.
 - 2. Include wiring connected to the car traveling cable.
 - 3. Telephone: Hands-free design complying with ADAAG requirements.
 - 4. Wire to PBX.

2.13 DOOR OPERATION

- A. Door Control Features:
 - 1. Electrically operated, quietly and smoothly operate car and hoistway doors.
 - a. Doors manually operable in emergency.
 - 2. Door control opens doors automatically when car arrives at landings in response to a normal hall or car call.
 - 3. Re-opening Device/Safety:
 - a. Purpose: To stop and reopen the car and hoistway doors automatically should the doorway become obstructed by an object or person.
 - b. Primary Device:
 - 1) 2-dimensional, multi-beam array projecting across the car door opening.
 - 2) Normal Operation:
 - a) Detect object, 1-1/3 IN diameter or larger, between the car doors in the following detection zone; within 1 IN to 71 IN above the sill.
 - 3) Degraded Conditions (one or more blocked or failed beams):
 - a) Detect object, 4 IN diameter or larger, in the same detection zone.
 - 4) If the system performance is degraded to the point that the 4 IN object cannot be detected; maintain the doors in open position, or permit closing only by nudging force conditions.
 - c. Secondary Device:
 - 1) 3-dimensional, triangular infrared multi-beam array projecting across the door opening and extending into the hoistway door zone.
 - 2) Operation: Cause the doors to reopen when it detects a person or object in the area between the hoistway doors or the entryway area adjacent to the hoistway doors.
 - 3) Secondary protection zone: Size varies with door positions.
 - 4. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

2.14 OPERATION AND LOGIC

- A. General Operating Features:
 - 1. Load Weighing Bypass: Car to bypasses hall calls, when car is filled to predetermined load.
 - 2. Independent Service: When switch in car is actuated, car operates independently from car buttons only and hall calls are ignored.
 - 3. Firefighters' Service Phase I and Phase II: Returns cars to designated floor by means of key operated switch located at a lobby designated by Fire Marshal.
 - 4. Top of Car Inspection: Disable car when inspection switch is activated.
 - 5. Load weighing dispatch: Dispatch car UP from Lobby as soon as either dispatch time interval has expired or weight sensing device has determined car is loaded.
- B. Simplex Collective Operation (1 car):
 - 1. General Description:
 - a. Microprocessor-based controller.
 - b. Operation: Automatic by means of the car and hall buttons.
 - c. If calls in the system have been answered, the car shall park at the last landing served.
 - 2. Operating Logic:
 - a. Momentary pressing of car or hall call buttons automatically starts car (assuming hoistway doors are shut).
 - b. Car stops automatically at first stop for which car or corridor button has been pressed, corresponding to direction in which car is traveling.
 - c. Car stops automatically, in order, at stops for which such stops have been registered.

- d. Car, when traveling in UP direction, answers UP calls, but passes stops where DOWN calls have been placed (unless DOWN call is at highest stop for which any button has been pressed).
- e. Pressing UP hall call button when car is traveling downward shall not intercept its travel, unless UP call is at floor for which lowest stop is registered.
- f. When car has responded to its highest or lowest stop, and calls are registered for opposite direction, travel reverses automatically and answers those calls.
- g. Should farthest stop in either direction be in response to corridor call, entering passenger at that floor may choose travel direction during predetermined period of time.
- h. Should both UP and DOWN calls be registered at intermediate floor when car is traveling to floor beyond, reset only call corresponding to direction opposite to that which car is traveling.
- i. Doors open only when stopping in response to calls.

2.15 EXPRESS PRIORITY SERVICE (CRYOGEN HAZARD SERVICE)

- 1. Applicable Elevator Number(s): Elevator #2 only.
- 2. Operating Logic:
 - a. When liquid cryogenics are to be transported via elevator, occupants must not ride on the elevator with the liquid cryogen due to an asphyxiation hazard within the confined elevator car. Therefore, it is absolutely essential for the elevator to be sent directly to the destination floor via express priority service.
 - b. Staff will use keypad to call car for immediate response.
 - c. Message indicator in selected car(s) shall inform passengers that the car is responding to a special call and that they are required to exit at next stop.
 - d. Upon arrival, doors open for predetermined time and shall be placed in independent service.
 - e. Staff will press button for destination floor and exit car.
 - f. Unoccupied car to travel in express mode directly to destination floor. Doors to open at destination floor and remain in independent service and locked to prevent further operation until independent service keypad is deactivated.
 - g. Car to resume normal service when independent service keypad is deactivated.
 - h. Illuminate signal light while car is responding to priority call and extinguish when car is placed on independent service or returned to normal service.
 - i. Signal light shall remain illuminated until car becomes available for priority service.
 - j. Additional priority calls cannot be initiated until signal light is extinguished.

2.16 EMERGENCY OPERATION

- A. Emergency power operation (manual):
 - 1. Provide automatic override switching to lower 1 car at a time to lobby on emergency power.
 - 2. After cars are lowered, select 1 car to operate on emergency power.
 - 3. Provide manual strip switch on lobby floor panel for individual selection of elevators.
 - 4. Contact on emergency switchgear to furnish signal through pair No. 12 wires to elevator controller that system is on emergency power.
 - 5. Manufacturer may attempt to rescue elevators at same time if power requirement in DOWN direction is small enough.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- B. Verify acceptability of machine rooms and shaftway to accept elevator and equipment.
- C. Notify Contractor / Construction Manager of unsatisfactory conditions.

- D. Do not proceed with work until unsatisfactory conditions are corrected.
- E. Start of installation constitutes acceptance of conditions and responsibility for performance.

3.2 ERECTION

- A. Erect sills, struts, hanger supports, hanger covers and unit frames, prior to erection of rough walls and set in proper relation to elevator car guides.
- B. Provide protective covering for finished frame and door surfaces.
- C. Projections into Shaftway exceeding 4 IN:
 - 1. Notify Contractor / Construction Manager where 75 degree bevels are necessary.
 - 2. GWB bevels: Specified in Section 09 29 00.
- D. Coordinate the installation of pit ladders ensuring that running clearances are maintained, location of ladder is optimal for servicing equipment, and in conformance with locally adopted codes.

3.3 GROUTING & CONCRETE FILL

- A. Fully grout the following:
 - 1. Hoistway entrance frames.
 - 2. Block-outs and other recessed items.
 - 3. Sills and thresholds.
 - 4. Grout:
 - a. Specified in Section 04 05 13.
- B. Closure between hoistway frames and CMU shaft walls:
 - 1. Fill with CMU and grout: Specified in Section 04 22 00 and Section 04 05 13.

3.4 DEMONSTRATION

- A. Assist Laboratory in inspection and certificating of elevator.
- B. Ensure that control systems and operating devices are functioning properly and conform with locally adopted codes.
- C. Elevator manufacturer shall make a final check of each elevator operation with the Laboratory's representative prior to turning each elevator over for use.

END OF SECTION