PUBLIC BUILDING COMMISSION OF CHICAGO

BOOK 3
TECHNICAL SPECIFICATIONS

PBC CONTRACT NO. C1615

FOREST PRESERVE DISTRICT OF COOK COUNTY ('FPDCC')
RESTROOM REHABILITATION DISTRICTWIDE
BUSSE WOODS & DAN RYAN WOODS
PBC PROJECT #15050
FPDCC PROJECT #23-80-41

PUBLIC BUILDING COMMISSION OF CHICAGO

Mayor Brandon Johnson

Ray Giderof
Executive Director

Room 200
Richard J. Daley Center
50 West Washington Street
Chicago, Illinois 60602
312-744-3090
www.pbcchicago.com

ISSUED FOR BID ON OCTOBER 24, 2024

By
SMNG A LTD.
W. SUPERIOR ST.
CHICAGO, IL 60642
(312)829-3355

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SECTION 00 01 00
SUPPLEMENTAL PROJECT INFORMATION

GENERAL

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders and is included in the Project Manual, including:

1. Environmental Scope Sheets for contract facilities located in Busse Woods Nature Preserve. Refer to Section 02 24 01 “Environmental Scope Sheets – Busse Woods”.
2. Environmental Scope Sheets for contract facilities located in Dan Ryan Woods. Refer to Section 02 24 01 “Environmental Scope Sheets – Dan Ryan Woods”.

B. The Contractor is responsible for coordination of information within the Supplemental Project Information with the applicable scope of work for this Project.

C. The Forest Preserve District of Cook County (FPDCC) and the Architect/Engineer of Record do not guarantee the accuracy or validity of the data, nor do they assume any responsibility for the Contractor's interpretation of the data.

D. Verification of data and existing conditions is the Contractor’s responsibilities. At Contractor's option, perform additional investigations at own expense.

PRODUCTS (NOT USED)

EXECUTION (NOT USED)

END OF SECTION

SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished products.
4. Access to site.
5. Work restrictions.
6. Specification and Drawing conventions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: FPDCC Restroom Rehabilitation.

1. Project Locations:

	Facility	Renovation		Name	Address
		Scope 1	Scope 2		
BASE SCOPE	1		X	Dan Ryan Woods Grove #9 (Visitor Center)	2318 W. 87th St. Chicago, IL 60620 UID: 689
	2	X		Dan Ryan Woods Grove #2	8395 S. Western Ave. Chicago, IL 60620 UID: 244
	3	X		Dan Ryan Woods Grove #10	8395 S. Western Ave. Chicago, IL 60620 UID: 465
	4	X		Dan Ryan Woods Grove #16	2288 W. 83rd St. Chicago, IL 60620 UID: 239
	5		X	Dan Ryan Woods Grove #4	8395 S. Western Ave. Chicago, IL 60620 UID: 243
	6		X	Busse Forest Main Dam Grove #27	400 S. Arl. Hts. Rd.. Elk Grove, IL 60007 UID: 595
	7		X	Busse Boating Center Building 'L'	11 E. Higgins Rd. Elk Grove, IL 60007 UID: 177

	Facility	Renovation		Name	Address
		Scope 1	Scope 2		
BASE SCOPE	8		X	Busse Forest Main Dam Grove #26 Building 'P'	400 S. Arl. Hts. Rd. Elk Grove, IL 60007 UID: 583
	9		X	Busse Forest South Grove #24	11 E. Higgins Rd. Elk Grove, IL 60007 UID: 167
	10		X	Busse Forest West Grove #31	20 E. Higgins Rd. Elk Grove, IL 60007 UID: 293
	11		X	Busse Elk Pasture	198 N. Arl. Hts. Rd. Elk Grove, IL 60007 UID: 310
	12		X	Busse Reservoir Grove #17	11 E. Higgins Rd. Elk Grove, IL 60007 UID: 167
ALTERNATES	13	X		Busse Forest Central Grove #4	30 E. Higgins Rd. Elk Grove, IL 60007 UID: 297
	14	X		Busse Ned Brown Grove #28	3399 Golf Rd. Elk Grove, IL 60007 UID: 70

B. Owner: Forest Preserve District of Cook County (FPDCC).

C. Developer: Public Building Commission of Chicago.

D. Project Lead (AOR): SMNG A Ltd., 943 W. Superior St. Chicago, IL 60642.

E. Project Lead Consultants: The Project Lead / Civil Engineer has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Associate Architect: Brook Architecture
   2301 S. Michigan Ave. Chicago, IL 60616
2. Civil: EVA Design and Engineering LLC
   420 W. Huron St. Chicago, IL 60654.
3. Structural: Stearn-Joglekar, Ltd.
   223 W. Jackson Blvd., Suite 1110, Chicago, IL 60606.
4. MEP/FP Engineer: Advance Consulting Group International
   300 W. Adams, Ste. 420, Chicago, IL 60606.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Renovations of existing Park District Toilet Rooms Districtwide. There are two general categories of work; Scope 1, largely cosmetic upgrades, and Scope 2 which includes additional upgrades.

2. Limited site restoration and development to support the building.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in one phase.

B. Contractor shall submit Contractor's construction schedule showing the sequence, commencement and completion dates for all phases of the Work.
   1. Schedule Critical Items: Long lead items are anticipated to include the prefabricated toilet room building renovations. The contractor shall prepare a list of these and any other long-lead items and submit the list to the Owner's Representative within 30-days of the Notice to Proceed.

1.6 OWNER FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products: Unless designated otherwise the following are to be owner-furnished and contractor installed:
   1. None.

ACCESS TO SITE

C. General: Contractor shall have use of Project site for construction operations during construction period but may be required to coordinate with other contractors completing work under a separate contract for work in the adjacent site areas. Contractor's use of Project site shall be detailed on their Site Utilization drawing and limited by the Owner's right to perform work or to retain other contractors on portions of Project.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

   2. Comply with work restrictions for ongoing programs in Beaubien Woods, coordinate with the Owner's Representative.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities serving the Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to the requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Obtain Owner's written permission before proceeding with utility interruptions.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors or other disruption to Owner or nearby properties.
   1. Notify Owner not less than two days in advance of proposed disruptive operations.
   2. Obtain Owner's written permission before proceeding with disruptive operations.

D. Non-smoking Building: Smoking is not permitted within the building or within 25 feet (8m) of entrances, operable windows, or outdoor air intakes.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

F. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

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

   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specification Sections.
   2. Abbreviations: Materials and products are identified by abbreviations as scheduled on Drawings.
   3. Graphic Symbols: Graphic symbols as scheduled on drawings and as commonly used to identify architectural, mechanical, electrical, plumbing, structural, landscape, and civil material components.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 23 00 “Alternates” for products selected under an alternate.

2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific

features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from Chicago Building Code, latest edition.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 15 days of receipt of additional information or documentation, whichever is later.

   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 25 00.01
SUBSTITUTION REQUEST FORM

FACILITY / PROJECT: _____

PROJECT ADDRESS(ES): _____

TO: ARCHITECT OF RECORD: _____

CC: OWNER REPRESENTATIVE: _____

DATE SUBMITTED: _____

GENERAL CONTRACTOR: _____

SUBMITTING CONTRACTOR
(if different from GC) _____

Address: _____

Contact Name: _____

Phone Number: _____

Email Address: _____

Ref. Spec. Section & Paragraph: _____

REQUESTED SUBSTITUTION:	
I/LO SPECIFIED MFR. / PRODUCT:	
Manufacturer Name:	
Product / Model:	
Manufacturer Address:	
Contact Name:	
Phone Number:	
Email Address:	

Reason For Substitution (select one of the following):

- ☐ **The specified product or method of construction is no longer available.**
- ☐ **There is no condition under which the specified product or method of construction can be installed as shown on the Contract Documents.**
- ☐ **There is no condition under which the specified product or method of construction can be provided within the time limits of the Contract.**
- ☐ **Additional benefits (in cost, time, or performance) are available to the Owner with the requested substitute product.**

Additional Explanation:

Attach applicable supporting documentation including, but not limited to, the following (select all that are included with this request):

- ☐ **Itemized Comparison** (of the requested substitution with product specified) **REQUIRED**
- ☐ **Performance and Test Data** (including performance against specified reference standards) **REQUIRED**
- ☐ **Manufacturer's Qualifications:** Evidence of manufacturer qualifications and reputation for prompt delivery and efficiency in servicing products. **REQUIRED**
- ☐ **Previous Installations:** Attach list of not less than 5 similar projects on which proposed substitution was used. List projects in the Chicago area. List name and address of project, date of installation, and name, address, and phone number of Architect. **REQUIRED**
- ☐ **Color Chart, illustrating Manufacturer's full range.** IF APPLICABLE
- ☐ **Installation Instructions.** IF APPLICABLE
- ☐ **Maintenance Instructions.** IF APPLICABLE
- ☐ **Changes in Work:** Attach data relating to changes required in other work to permit use of proposed substitution and changes required in construction schedule. IF APPLICABLE
- ☐ **Cost Data:** Attach accurate cost data on proposed substitution in comparison with product specified. IF APPLICABLE

In making this request for substitution, the Submitting Contractor and General Contractor represents that:

a. Contractor has examined the Contract Documents and investigated the proposed product/system and has determined that the proposed substitution is appropriate for the use intended for this Project and shall meet or exceed the quality level of the specified product/system.
b. Contractor shall provide the same warranties for the substituted product/system as required for the product/system specified.

c. Contractor shall coordinate installation of accepted substitution into Work, and make changes to other Work that may be required for the Work to be complete with no additional cost to the Board.
d. Contractor waives all claims for additional costs related to accepted substitutions that may subsequently become apparent.
e. Cost data is complete and includes all related costs for this Project.

SUBMITTING COMPANY NAME:_____

Printed Name & Title: _____

Authorized Signature: _____

Date: _____

REVIEWED BY INSTALLER: (company name): _____

Printed Name & Title: _____

Authorized Signature: _____

Date: _____

REVIEWED BY MANUFACTURER: (company name): _____

Printed Name & Title: _____

Authorized Signature: _____

Date: _____

REVIEWED BY GENERAL CONTRACTOR: (company name): _____

Printed Name & Title: _____

Authorized Signature: _____

Date: _____

Requests that are not complete will be returned by the AOR/EOR for additional information.

Requests that do not meet Owner requirements for acceptable substitutions will be rejected.

AOR/EOR REVIEW: The submitted information has been reviewed by the Architect/Engineer of Record and found to be complete and meets the Board requirements for acceptable substitution

Agreement By (Name): _____

AOR/EOR Firm Name:_____ ***Date:***_____

OWNER'S REPRESENTATIVE REVIEW:

Substitution Accepted by PBC: _____Date:_____Submit substituted product for review

Substitution Rejected by PBC: _____Date:_____Submit specified product for review

SECTION 01 35 62

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Erosion and Sedimentation Control Program for the Project.

1.2 SUBMITTALS

A. Erosion and Sediment Control Plan

1. Submit erosion and sediment control drawings specific to the site within ten (10) days of Notice To Proceed (NTP). Show locations, types and details of erosion and sediment control features and construction.
2. Show the schedule of implementation coordinated with the construction schedule.
3. Include a narrative describing the program and maintenance.

B. Product Data

1. Silt Fence Geotextile Filter Fabric
2. Silt Sock
3. Filter Baskets
4. Other Erosion Control products

C. Documentation Log

1. Provide weekly inspection logs of inspection and maintenance of all erosion control procedures.

a. Include additional inspections for rainfalls over ½".

2. Provide photographs during construction illustrating implementation of erosion control measures and on-going repairs/maintenance to these measures. At minimum photographs should be documented for:

a. Before Construction
b. During Construction
c. After Construction

1.3 QUALITY ASSURANCE

A. Requirements: Create and implement an Erosion and Sedimentation Control plan, specific to the site, which conforms to the erosion and sedimentation requirements of the 2003 United States Environmental Protection Agency (EPA) Construction General Permit, OR local erosion and sedimentation control standards and codes, whichever is more stringent. The Construction General Permit outlines the provisions necessary to comply with Phase I and Phase II Of the National Pollution Discharge Elimination (NPDES) program.

B. Objectives:

1. Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting stockpiles for reuse.
2. Prevent sedimentation of storm sewer or receiving streams.
3. Prevent polluting the air with dust and particulate matter.

PART 2 - PRODUCTS

2.1 Silt Fence:

A. Geotextile Filter Fabric: A nonwoven fabric consisting of previous sheets of propylene, nylon, polyester, or ethylene yarn. Certify material by manufacturer to meet the following requirements. Pre-assembled silt fencing may be substituted if it meets the requirements below.

Property	Test Method	Requirements
Minimum Tensile Strength	ASTM D4632	90 lb
Maximum Elongation at 45 lb	ASTM D4632	50% Max
Apparent Opening Size	ASTM D4751	AOS<60 mm
Minimum Permittivity	ASTM D4491	$1x10^{-2}$ SEC $^{-1}$
Ultraviolet Exposure Strength Retention	ASTM D4355	70% @ 500h

B. Posts: Wood or steel and a minimum 5 ft long. Wood posts shall be at least 4 in. dia. Or nominal 2 x 2 in. Steel posts shall be round or “U”, “T”, or “C” shaped with a minimum weight of 1.33 lb/ft and projections for fastening wire to fence. Wire Staples: 9 gage and minimum 1 in. long.

2.2 INLET FILTER

A. FILTER BASKETS

1. CATCH –ALL (or equal)
   As manufactured by:
   METRO DETROIT
   Price and Company, Inc.
   29165 Wall Street
   Wixom, MI 48393-3525
   Toll Free: 866.960.4300
   Local T: 248.596.4300
   F: 248.596.4301
   E: geopro@priceandcompany.com

2.3 CONSTRUCTION ENTRANCE

A. Aggregate size: CA-1 or CA-4

B. Geotextile fabric: shall meet the requirements of specification 592 Geotextile table 1 or 2, class I, II or IV of the Illinois Urban Manual.

2.4 Temporary Seeding Plants

A. Shall be selected from the following:

TEMPORARY SEEDING SPECIES, RATES AND DATES

Species	Lbs/Acre	Lbs/1000 sf	Seeding dates
Oats	90	2	Early spring-July 1

Cereal Rye	90	2	Early spring-Sept. 30
Wheat	90	2	Early spring-Sept. 30
Perennial Ryegrass	25	0.6	Early spring-Sept. 30

2.5 OTHER EROSION CONTROL PRODUCTS

A. Silt Sock:

1. Basis of Design: SiltSoxx by Filtrexx. Diameter shall be 12” rated for 95% removal efficiency.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not start operations until the erosion and sediment control plan has been submitted and features and in place.

B. Schedule the Work in start to finish phases to minimize exposing the site to erosion.

C. Install erosion and sediment control features before site disturbance begins and immediately after new inlets are installed.

D. Do not allow storm water to flow into excavations and disturbed areas.

E. Do not discharge water into sanitary sewers, watercourses or offsite.

F. Do not discharge water-containing sediment in accordance with “Quality Assurance” requirements and as presented in the erosion and sediment control plan submittal or a maximum retained as 30 milligrams of sediment per liter of water. Conduct continuous monitoring of sediment.

G. Maintain sediment control features. Inspect weekly and after every rain. Repair damaged bales, end runs and undercutting beneath bales. Repair breaks in diversion dams and damage down streams of the break. Replace damaged and deteriorated filter fabric and fences. Remove sediment which deposits fill 1/3 of the fabric surface area.

H. Do not allow sediment to flow into vegetated areas.

I. Retain all sediment on the site. Provide temporary stone roadways at exits from the site to ensure mud run-off of tires before exiting.

J. Utilize the sizes of equipment appropriate to the task to minimize exhaust, noise and vibration.

K. Mist or provide other means to keep dust from being scattered to the air.

L. All sediment that gets onto public right-of-way must be removed immediately.

M. During dewatering operations, water will be pumped into sediment basins or silt traps. Dewatering directly to field tiles or storm sewer is prohibited.

N. Stockpile must be kept covered and watered for dust control.

3.2 INSTALLATION/APPLICATION/ERECTION

A. General: Control surface water runoff on-site and provide temporary soil stabilization measures as required to prevent erosion of soil by action of water. Protect storm sewers adjacent to work site from sedimentation by installation of erosion and sediment control measures. Provide, as a first step in construction operations, barriers, and other measures intended to deter erosion and transport of sediment associated with construction activities before construction starts or as it progresses.

B. Silt Fences: Space posts 6 ft maximum for non-reinforced or 10 ft maximum for reinforced and securely install with at least 2 feet of post in the ground. Excavate trench approximately 4 in. wide and 4 in. deep along line of posts and upslope side of posts using wire staples, tie wires, or hog rings. Extend wire and fence into trench a minimum of 4 in. Attach geo-textile filter fabric directly to posts and wire reinforcement fence as required by wire, staples, or other means accepted by the ANL CFR. Install filter fabric in a manner such that fabric height above grade is 2 to 3 ft. Do not staple fabric to trees. Do not use fabric with defects or other damage. For manholes, the filter fabric can be placed around the lid and secured by the lid weight.

C. Construction Entrance: Construct with minimum dimensions of 14’ wide, 70’ length and 6” thickness of CA-1 or CA-4. Filter fabric shall be used under the aggregate to minimize the migration of stone into the underlying soil by heavy vehicle loads. See plans for location.

D. Temporary Seeding: Remove large rocks or other debris that may interfere with seedbed preparation or seeding operations. Prepare seedbed of 3 to 4 inches loose soil. If rainfall has caused the surface to become sealed or crusted, loosen, by suitable method, it just prior to seeding. Where pH is below 5.5 and seeding will not take place within 30 days, apply one and one half to two tons per acre of finely ground agricultural limestone. Seeding shall be evenly applied with a cyclone seeder, drill, culti-packer seeder or hydroseeder. Small grains shall be planted no more than one inch deep. Grasses shall be planted no more than one half inch deep.

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

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

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

   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface

between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or as part of permanent construction, consisting of multiple products, assemblies, and subassemblies.

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

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

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

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

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 DELEGATED-DESIGN SERVICES

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

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.

B. 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 requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups.
   1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
   2. Indicate manufacturer and model number of individual components.
   3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.7 INFORMATIONAL SUBMITTALS

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

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

C. Contractor’s Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

D. Qualification Data: For Contractor’s quality-control personnel.

E. Contractor’s Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
   1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
   2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

F. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

G. Reports: Prepare and submit certified written reports and documents as specified.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of work requiring testing or inspection, include the following:
   1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
   2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
   3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

   1. Date of issue.
   2. Project title and number.
   3. Name, address, telephone number, and email address of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and e-mail address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and e-mail address of technical representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

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

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

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

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

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

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

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, the Contractor shall engage an Independent Testing Agency for the performance of all testing and inspection to demonstrate successful performance of assemblies and components as applicable. The Contractor shall be responsible for engaging the Independent Testing Agency for all re-testing and re-inspection required until the assemblies and components is demonstrated and documented.

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for project.
e. When testing is complete, remove test specimens and test assemblies and mockups; do not reuse products on Project.

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

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

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelop materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in “Mockups” Paragraph.

M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.11 QUALITY CONTROL

A. Contractor Responsibilities: All tests and inspections are the Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Quality-Control services are the Contractor’s responsibility; submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

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

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

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

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

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

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

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor’s quality-control plan. Coordinate and submit concurrently with Contractor’s Construction Schedule. Update as the Work Progresses.
1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
   1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and, where required, to authorities having jurisdiction.
   3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   5. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide a progress copy of the log at each Owner, Architect Contractor progress meeting; clearly identify where tests demonstrate compliance or non-compliance and identify remedial procedures. Provide access to test and inspection log for Architect's reference during normal working hours.

   1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

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

   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

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

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

END OF SECTION 01 40 00

SECTION 01 42 00
REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless 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 standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should 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, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
4. ABMA - American Boiler Manufacturers Association; www.abma.com.
5. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
6. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
7. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
8. AF&PA - American Forest & Paper Association; www.afandpa.org.
9. AGA - American Gas Association; www.aga.org.
10. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
11. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
12. AI - Asphalt Institute; www.asphaltinstitute.org.
13. AIA - American Institute of Architects (The); www.aia.org.
14. AISC - American Institute of Steel Construction; www.aisc.org.
15. AISI - American Iron and Steel Institute; www.steel.org.
16. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
17. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
18. ANSI - American National Standards Institute; www.ansi.org.
19. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
20. APA - APA - The Engineered Wood Association; www.apawood.org.
21. APA - Architectural Precast Association; www.archprecast.org.
22. API - American Petroleum Institute; www.api.org.
23. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
24. ARI - American Refrigeration Institute; (See AHRI).
25. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
26. ASCE - American Society of Civil Engineers; www.asce.org.
27. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
28. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
29. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
30. ASSE - American Society of Safety Engineers (The); www.asse.org.
31. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
32. ASTM - ASTM International; www.astm.org.
33. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
34. AWI - Architectural Woodwork Institute; www.awinet.org.

35. AWPA - American Wood Protection Association; www.awpa.com.
36. AWS - American Welding Society; www.aws.org.
37. AWWA - American Water Works Association; www.awwa.org.
38. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
39. BICSI - BICSI, Inc.; www.bicsi.org.
40. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
41. CDA - Copper Development Association; www.copper.org.
42. CEA - Consumer Electronics Association; www.ce.org.
43. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
44. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
45. CGA - Compressed Gas Association; www.cganet.com.
46. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
47. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
48. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
49. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
50. CPA - Composite Panel Association; www.pbmdf.com.
51. CRRC - Cool Roof Rating Council; www.coolroofs.org.
52. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
53. CSA - CSA Group; www.csagroup.com.
54. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
55. CSI - Construction Specifications Institute (The); www.csinet.org.
56. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
57. CWC - Composite Wood Council; (See CPA).
58. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
59. DHI - Door and Hardware Institute; www.dhi.org.
60. ECA - Electronic Components Association; (See ECIA).
61. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
62. ECIA - Electronic Components Industry Association; www.eciaonline.org.
63. EIA - Electronic Industries Alliance; (See TIA).
64. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
65. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
66. ETL - Intertek (See Intertek); www.intertek.com.
67. EVO - Efficiency Valuation Organization; www.evo-world.org.
68. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
69. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
70. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
71. FM Approvals - FM Approvals LLC; www.fmglobal.com.
72. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
73. FSA - Fluid Sealing Association; www.fluidsealing.com.
74. GA - Gypsum Association; www.gypsum.org.
75. GANA - Glass Association of North America; www.glasswebsite.com.
76. HI - Hydraulic Institute; www.pumps.org.
77. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
78. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
79. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
80. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
81. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
82. IAS - International Accreditation Service; www.iasonline.org.
83. IAS - International Approval Services; (See CSA).
84. ICBO - International Conference of Building Officials; (See ICC).
85. ICC - International Code Council; www.iccsafe.org.
86. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.

87. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
88. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
89. IEC - International Electrotechnical Commission; www.iec.ch.
90. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
91. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
92. IESNA - Illuminating Engineering Society of North America; (See IES).
93. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
94. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
95. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
96. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
97. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
98. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
99. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
100. ISO - International Organization for Standardization; www.iso.org.
101. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
102. ITU - International Telecommunication Union; www.itu.int/home.
103. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
104. LMA - Laminating Materials Association; (See CPA).
105. MCA - Metal Construction Association; www.metalconstruction.org.
106. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
107. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
108. MHIA - Material Handling Industry of America; www.mhia.org.
109. MPI - Master Painters Institute; www.paintinfo.com.
110. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
111. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
112. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
113. NADCA - National Air Duct Cleaners Association; www.nadca.com.
114. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
115. NBI - New Buildings Institute; www.newbuildings.org.
116. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
117. NCMA - National Concrete Masonry Association; www.ncma.org.
118. NEBB - National Environmental Balancing Bureau; www.nebb.org.
119. NECA - National Electrical Contractors Association; www.necanet.org.
120. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
121. NEMA - National Electrical Manufacturers Association; www.nema.org.
122. NETA - InterNational Electrical Testing Association; www.netaworld.org.
123. NFHS - National Federation of State High School Associations; www.nfhs.org.
124. NFPA - National Fire Protection Association; www.nfpa.org.
125. NFPA - NFPA International; (See NFPA).
126. NFRC - National Fenestration Rating Council; www.nfrc.org.
127. NHLA - National Hardwood Lumber Association; www.nhla.com.
128. NLGA - National Lumber Grades Authority; www.nlga.org.
129. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
130. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
131. NRCA - National Roofing Contractors Association; www.nrca.net.
132. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
133. NSF - NSF International; www.nsf.org.
134. NSPE - National Society of Professional Engineers; www.nspe.org.
135. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
136. NWFA - National Wood Flooring Association; www.nwfa.org.

137. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
138. PDI - Plumbing & Drainage Institute; www.pdionline.org.
139. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
140. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
141. RFCI - Resilient Floor Covering Institute; www.rfci.com.
142. SAE - SAE International; www.sae.org.
143. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
144. SDI - Steel Deck Institute; www.sdi.org.
145. SDI - Steel Door Institute; www.steeldoor.org.
146. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
147. SIA - Security Industry Association; www.siaonline.org.
148. SJI - Steel Joist Institute; www.steeljoist.org.
149. SMA - Screen Manufacturers Association; www.smainfo.org.
150. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
151. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
152. SPIB - Southern Pine Inspection Bureau; www.spib.org.
153. SPRI - Single Ply Roofing Industry; www.spri.org.
154. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
155. SSINA - Specialty Steel Industry of North America; www.ssina.com.
156. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
157. STI - Steel Tank Institute; www.steeltank.com.
158. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
159. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
160. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
161. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
162. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
163. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
164. TMS - The Masonry Society; www.masonrysociety.org.
165. TPI - Truss Plate Institute; www.tpinst.org.
166. TPI - Turfgrass Producers International; www.turfgrasssod.org.
167. TRI - Tile Roofing Institute; www.tileroofing.org.
168. UL - Underwriters Laboratories Inc.; www.ul.com.
169. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
170. USAV - USA Volleyball; www.usavolleyball.org.
171. USGBC - U.S. Green Building Council; www.usgbc.org.
172. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
173. WASTEC - Waste Equipment Technology Association; www.wastec.org.
174. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
175. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
176. WDMA - Window & Door Manufacturers Association; www.wdma.com.
177. WI - Woodwork Institute; www.wicnet.org.
178. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
179. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
   1. CBC – Chicago Building Code: https://codes.iccsafe.org/content/CHIBC2019P2
   2. IAC – Illinois Accessibility Code;

https://r.search.yahoo.com/_ylt=AwrEzetqUqlgOkQAhLBXNyoA;_ylu=Y29sbwNiZjEEcG9zAzQEdnRpZAMEc2VjA3Ny/RV=2/RE=1621738218/RO=10/RU=https%3a%2f%2fwww2.illinois.gov%2fcdb%2fannouncements%2f2018%2fPages%2fNew-Illinois-Accessibility-Code.aspx/RK=2/RS=THcrvoBSr.vQDiRtXJGN0Cfm8bk-

3. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org
4. ICC – Internationl Code Council; www.iccsafe.org.
5. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FG - Federal Government Publications; www.gpo.gov/fdsys.
8. OSHA - Occupational Safety & Health Administration; www.osha.gov.
9. SD - Department of State; www.state.gov.
10. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
11. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
12. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
13. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
14. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. CDB; Capital Development Board of Illinois; https://www2.illinois.gov/cdb/Pages/default.aspx
7. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:
1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

E. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

F. Moisture-and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: New and replacement sections shall be minimum 2-inch (50-mm), 0.148-inch (3.8mm) thick, galvanized steel chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch (60-mm) O.D. line posts and 2-7/8-inch (73-mm) O.D. corner and pull posts, with 1-5/8-inch (42-mm) O.D. top and bottom rails. Driven posts shall be extended to frost depth.
   1. Contractor shall procure, maintain, modify and supplement construction fencing and gates as required for construction operations, and shall fully remove at the completion of the project and repair conditions to satisfaction of FPDCC.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
6. Wireless internet service and firewall suitable for computer use during construction.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Section 01 10 00 “Summary”.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
   1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
   1. Install electric power service overhead unless otherwise indicated, or underground if required for construction operations.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and land-based telephone line(s) for each field office.
   1. Provide additional telephone lines for the following:
      a. Provide one telephone line for Owner's use.
   2. At each telephone, post a list of important telephone numbers, including:
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Contractor's emergency after-hours telephone number.
      e. Architect's office.
      f. Engineer's offices.
      g. Owner's office.
      h. Principal subcontractor's field and home offices.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touch up signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
   1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Section 01 10 00 “Summary”.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 31 11 00 "Site Clearing."
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Section 01 56 39 "Temporary Tree and Plant Protection."

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence and gates in a manner that will prevent people from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel, furnish one set of keys to Owner.
   3. Contractor shall utilize, maintain, modify and supplement existing construction fencing, gates and associated elements as required for construction operations, and shall fully remove at the completion of the project.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.

6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
   c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in PBC Book 2.

END OF SECTION 01 50 00

SECTION 01 56 11
GENERAL DUST, FUME AND ODOR CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Dust and fume emission control is required to maintain a healthy environment, maintain good public relations with neighbors and employees, prevent damage, minimize cleaning and maintenance costs, and to comply with regulations and laws. All contractors (including subcontractors, lower-tier subcontractors, and suppliers) who perform work or provide services at FPDCC are required to control dust and fume emissions from their operations and/or activities.

1.3 DEFINITIONS

A. In addition to the terms listed below, all definitions in the laws and regulations specified elsewhere in this Section are incorporated by reference, whether or not restated herein.

B. Architect of Record (AOR) means the entity that assembles the overall documents and bid package, and approves the completed work.

C. Owner’s Representative (PBC) means the owner of the property and the authority ordering the work specified herein.

D. General Contractor (GC) means the entity responsible for performing the complete scope of work in the Documents. The GC may elect to self-perform or subcontract out any portion of the work.

E. HEPA Filter means a High Efficiency Particulate Air filter capable of trapping 99.97% percent of particles greater than 0.3 micrometers in mass median aerodynamic equivalent diameter.

F. MSDS means Material Safety Data Sheets, required by OSHA for any chemical in the workplace that that could be expected to cause an exposure to workers during normal use or in emergency situations.

G. Plasticize means to apply plastic sheeting over surfaces or objects to protect them from contamination or water damage.

H. Personal Protective Equipment (PPE) means the protective suits, head and foot covers, gloves, respirators and other items used to protect persons from potential hazards.

I. Work Area means the area or areas where work is being conducted.

1.4 WORK INCLUDED

A. The work includes the control of all nuisance or noxious dust, vapors, fumes, odors or emissions caused by construction, demolition, or related activities including, but not limited to sawing, cutting, grinding, sanding, abrading, sweeping, crushing, scraping, gluing, prying,

plowing, heating, finishing, painting, welding, torch cutting or burning, or any other related processes at FPDCC facilities that can create noxious dust, fumes or odors.

B. No visible emissions or unreasonable odors shall be permitted outside the work area.

C. All products to be used at the project site that could potentially emit dusts, fumes, vapors or odors, etc. shall be submitted to the Owner for approval prior to the use of the product.

1.5 LAWS, REGULATIONS, AND STANDARDS.

A. The Contractor is responsible for compliance with all applicable federal, state, county and municipal laws, regulations and ordinances including, but not limited to, those listed below, which are incorporated by reference.

B. The following laws, regulations and standards are incorporated by reference:

1. 29 CFR 1910: US OSHA General Industry Standards.
2. 29 CFR 1926: US OSHA Construction Standards.
3. 40 CFR Part 61: USEPA National Emissions Standards for Hazardous Air Pollutants (NESHAP).
4. 11-4-2170: Chicago Building Code - Demolition and renovation safeguards.
5. 11-4-2190: Chicago Building Code: Sandblasting, grinding and chemical washing of buildings, facilities or other structures - Dust minimization--Containment, wetting or vacuuming; plan required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 BARRIERS OR WORK AREA ISOLATION

A. Contractors shall prevent the spread of dust, fumes and odors from their immediate work areas by:

1. Erecting dust-tight barriers between indoor work areas and adjacent occupied areas. Construction barriers may be used for this purpose if suitably constructed to prevent dust, fume or odor migration.
2. Closing and or covering windows, intake vents, louvers, or other building openings in the immediate vicinity of outdoor work, sufficient to prevent dust, fume or odor migration into the building interior. If such openings cannot be adequately sealed by closing, then poly sheeting, tape, or other impermeable covers shall be used.
3. The contractor shall provide a filtered, local exhaust system for the isolated work area.

B. Contractor is prohibited from creating other hazardous or uncomfortable conditions for building occupants, such as very hot, humid, cold, or other conditions created by ventilation system alterations or blockages, closed or open windows in hot or cold weather conditions.

C. Contractor is responsible for making itself familiar with building conditions and shall take care to isolate its work area in such a manner that building occupant activities and comfort are not unreasonably disrupted.

3.2 DUST, FUME AND ODOR CONTROL

A. Dust, fume or odor release shall be prevented by a suitable means, including but not limited to:

1. Tools equipped with shrouds, HEPA filter equipped vacuum pickups.
2. Alteration, shut down, or isolation of building ventilation systems in the immediate work vicinity.
3. Shrouding around work activities.
4. Shrouding stages, scaffolds, or other work platforms.
5. Local exhaust ventilation systems exhausted to the outside of the building.
6. Wet work methods.

B. It is the Contractor's responsibility to select the means and methods it considers most suitable to achieve dust, fume and odor control.

C. In the event that dust or fumes escape from the work area or create dirty conditions or contamination to nearby building spaces or grounds, the Contractor is responsible for all costs associated with the cleaning, testing and/ or repair deemed necessary by the Owner.

END OF SECTION 01 56 11

SECTION 01 57 15
INTEGRATED PEST MANAGEMENT DURING CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Provide supervision, labor, materials, reporting and equipment necessary to facilitate an Integrated Pest Management (IPM) program for the construction duration.
2. Prevent the ingress of rodents and pests during construction.

1.3 DEFINITIONS

A. Integrated Pest Management (IPM): An approach to pest control that utilizes regular monitoring and record keeping to determine if and when treatments are needed.

B. Integrated Pest Management Plan (IPMP): The IPMP monitors, identifies, assesses injury levels, sets action levels, implement treatments, and monitors results.

C. Integrated Pest Management Coordinator (IPMC): individual provided by Contractor to develop and oversee the IPMP and to oversee pesticide application on FPDCC property.

D. Pesticide: any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.

E. Rodents and Pests: means arthropods, rodents, roaches, nematodes, snails, insects, termites, snakes and other vermin that adversely affect readiness, building operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.4 PERFORMANCE REQUIREMENTS

A. IL Structural Pest Control Act 225 ILCS 235 3.24

B. EPA Registration of Pesticide Products in accordance with the Federal Insecticide Fungicide and Rodenticide Act (FIFRA).

C. City of Chicago Department of Public Health.

D. When there is a conflict between applicable regulations, the most stringent will apply.

1.5 SUBMITTALS

A. Qualification Data: For Contractors IMPC.

B. IPMP Initial: All aspects of the IPMP shall be in accordance with Federal, State, and the City of Chicago laws and regulations. The Contractor’s initial IPMP submittal shall be submitted within

30 days of Contractors mobilization to the project site and shall include, but not necessarily be limited to, the following items:

1. Proposed Materials and Equipment for Service.
2. Proposed Methods for Monitoring and Detection.
3. Proposed Service Schedule for each building, site, or phase.
4. Commercial Pesticide Applicator Name, Address, Phone contact, Certificates or Licenses.
5. List of existing buildings or structures within 50 feet of limits of construction.
6. Site locator map on 11x17 size showing each building, site, or phase.

C. IPMP Updates: The Contractor is responsible for maintaining a pest control logbook. The Contractor's IPMP shall be updated monthly for the duration of the project and shall include, but not necessarily be limited to, the following:

1. All contents of IPMP Initial submittal.
2. Records pertaining to routine inspections for signs of pests.
3. Records pertaining to responses to pest emergencies.
4. Record of recommendations for structural and procedural modifications necessary to achieve pest prevention.
5. Records of the control measures performed, all pesticides used, surveillance and trapping components used, labels and MSDS sheets, brand names.
6. Monthly update to include dates and times Contractor's IPMC visited the site, names of personnel who applied the pest control pesticides and set up trapping devices.
7. Contractor's personnel training meeting minutes.

D. Final Acceptance Affidavit.

1.6 QUALITY ASSURANCE

A. IPMC Qualifications: Contractor to provide the services of an Illinois licensed and certified exterminator company with minimum 10 years of experience, whose principal business is pest control.

B. Training of Personnel: The Contractor's personnel shall be trained that IPM is being implemented on the project. Conduct a pest control meeting for all personnel prior to commencing IPM activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: familiarization with the methods of installation, care of devices and instruments used for monitoring, anticipated hazardous or toxic chemicals or other regulated contaminants when applicable. Contractor shall keep meeting notes to include in the IPMP updates.

C. Pesticide Treatment Plan:

1. Comply with Federal, State, and Local pest management record keeping and reporting requirements.
2. Reporting: Include and update records in the IPM the sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment.
3. Application of all pesticides shall be by an Illinois licensed and certified exterminator with minimum 5 years of experience on projects of similar size and scope.

1.7 FINAL ACCEPTANCE

A. Before final acceptance of the building, the Contractor shall provide a statement in affidavit form, signed by the IPMC that the building premises are free from rodents and pests, and that all pesticides and related control devices and instruments have been properly removed or disposed of in accordance with label directions.

1.8 DELIVERY, STORAGE AND HANDLING

A. Pesticide Delivery and Storage:

1. Deliver pesticides to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Store pesticides according to manufacturer's instructions and under lock and key when unattended.
2. Licensed Applicator may bring pre-mixed product in EPA approved compressed sprayer-type container providing product is listed in the IPMP and follows all EPA and manufacturer label requirements.

B. Pesticide Handling Requirements: Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and use the clothing and personal protective equipment specified on the labeling for use during all phases of the application. Furnish Material Safety Data Sheets (MSDS) for all pesticide products for owners use.

PART 2 - PRODUCTS

2.1 EXTERMINATION CONTRACTOR

A. Select from the following Firms:

1. Alpha Omega Pest Control Corp.
2. Anderson Pest Control
3. Orkin Pest Control
4. Quality Excellence Pest Control, Inc.
5. Smithereen Exterminating Co.
6. Rose Pest Control

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with all applicable laws, rules and regulations.

3.2 PROTECTION

A. Provide egress, barricades, signage and warnings as may be required by the IPMC during IPM operations.

3.3 CLEANING

A. Remove all pesticides, related control devices and instruments in accordance with label

directions and the IPMC.

3.4 PERSONAL PROTECTION AND EQUIPMENT

A. Apply pesticides using an Illinois licensed and certified exterminator in accordance with EPA label restrictions and recommendations.

B. The Licensed Applicator shall wear clothing and personal protective equipment as specified on the pesticide label.

C. The CR will designate locations for water used in formulating. Do not allow the equipment to overflow.

D. Inspect all equipment for leaks, clogging, wear, or damage and repaired prior to application of pesticide.

E. Clean all previously used equipment prior to bringing it onto the project site. Ensure that the equipment is free from residuals.

3.5 PESTICIDE USE

A. The Contractor shall adhere to the following minimum rules for pesticide use in accordance with the IPMP:
   1. Minimize environmental pollution and damage that may occur as the result of Pest Control measures.
   2. Protect the environmental resources within the project boundaries, and those affected outside the limits of permanent work, during the entire duration of the project.
   3. Comply with all applicable environmental Federal, State, and local City of Chicago laws and regulations. Any delays resulting from failure to comply with environmental laws and regulations shall be the Contractor's responsibility.
   4. Do not apply any pesticide product that has not been included in the IPMP.
   5. Do not store any pesticide product in any area on the construction site not specified in the IPMP.
   6. Pesticide application shall be according to need and not by schedule.
   7. When pesticide use is necessary, employ the least hazardous material, most precise application technique, and minimum quantity of pesticide necessary to achieve control.

3.6 RODENT CONTROL

A. The Contractor shall adhere to the following minimum rules for rodent control in accordance to the IPMP:
   1. Trapping Devices: All such devices shall be in protected areas so as not to be affected by routine operations. Trapping devices shall be checked on a schedule approved by the IPMC.
   2. All rodenticides shall be placed either in locations not accessible to children, pets, wildlife, and domestic animals, or in EPA-approved tamper-resistant bait boxes.
   3. Use of Bait Boxes: All bait boxes shall be maintained in accordance with EPA regulations, lids shall be securely locked or fastened shut, bait boxes shall be securely attached or anchored to the floor, ground, or wall, or in EPA-approved tamper resistant boxes labeled on the interior with IPMC business name and address.
   4. The Contractor shall be responsible for disposing of all trapped rodents and all rodent carcasses in an appropriate manner.

END OF SECTION 01 57 15

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
   2. Section 01 42 00 “References” for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request or 15 days of receipt of additional information or documentation, whichever is later.

      a. Form of Architect's Approval of Submittal: As specified in PBC Book 2.
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Book 2 related to Submittal Procedures. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that 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 following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.
   3. See individual identification sections in Division 21, 22, 23, and 26 for additional identification requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

2. 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.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term “or equal”, or “or approved equal”, or “or approved”, comply with requirements in “Comparable Products” Article to obtain approval for use of an unnamed product.
    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of “or equal” product status is by the Architect, whose determination is final.

B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor’s convenience will not be considered.
    a. Sole product may be indicated by the phrase: “Subject to compliance with requirements, provide the following:…”.

2. Sole Manufacturer / Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor’s convenience will not be considered.
    a. Sole manufacturer / source may be indicated by the phrase: “Subject to compliance with requirements, provide products by the following…..”.

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"

4. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
   2. Evidence that proposed product provides specified warranty.
   3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   4. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Surveying for laying out the work.

D. Shoring, bracing, and scaffolding.

E. Progress cleaning and protection of work.

F. Starting of systems and equipment.

G. Correction of the Work.

H. Final cleaning.

1.02 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.

B. See Division 02 for requirements related to removal and waste management.

C. Cleaning:
1. Product Data: Submit complete printed data for cleaning agents and floor sealers finishes.
2. Qualification Data: Submit supporting documentation demonstrating personnel engaged for Final Cleaning are regularly engaged in commercial and institutional building cleaning and maintenance as a primary business for a minimum of five (5) years.
3. Certification: Submit a statement that all final cleaning as specified is complete on company letter head signed by an officer of the cleaning company.

D. Project Record Documents: Submit 6 copies of record documents. Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

A. All work shall comply with all applicable laws, codes and regulations.

B. Signs: No signs advertising the work or identifying any person, firm or entity concerned with the work shall be allowed at the site unless approved in advance by the Owner's Representative. The Contractor is to maintain the project sign provided by the Owner.

C. No press or public relation releases are to be made without approval of the Owner.

D. Use of explosives is not permitted.

E. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

F. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

G. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

H. Conduct operations to minimize fumes or odors to building air intakes. Advise Owner's Representative if a problem is foreseen so that concerned parties can be notified in advance.

I. The Contractor shall include in the bid costs for all standby trades should work need to be performed during other than normal work hours. This may include electrical tie-in, water taps, abatement (lead/asbestos/tank removal), work which is excessively noisy (i.e. grinding, demolition etc.); removal of materials containing lead based paints etc. Costs for inspections and any other additional work related to the Contract scope deemed necessary by Commonwealth Edison, City - Water, Sewer and Sanitary department are to borne by the Contractor.

J. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Install, maintain and effectively operate appliances, machines or equipment in a manner approved by authorities having jurisdiction for the elimination of dust.

K. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations. Do not use tools or equipment that produce harmful noise levels.

L. Dewatering: If required, dewater trenches, footings, pits and excavations made for the work. Discharge the water so as not to interfere or create safety hazards to the public or allow water to run on other property. Adhere to all federal, state and city regulations.

M. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Coordinate scheduling and timing of required administrative procedures with construction activities and activities of other contractors (where applicable) to avoid conflicts and to ensure orderly progress of the Work.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

F. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

G. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

H. Coordinate completion and clean-up of work of separate sections.

I. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS

A. Cleaning Agents and floor sealers-finishes: Use cleaning materials and agents and floor sealers-finishes recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

B. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Review conditions with installer or applicator present where indicated to confirm compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Record observations. Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
      a. Description of the Work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.
      d. Recommended corrections.

B. Verify that existing substrate is suitable for new work being applied or attached including structural readiness and compatibility with finishes.

C. Examine and verify specific conditions described in individual specification sections.

D. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

E. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.

F. Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Verify space requirements and dimensions of items shown diagrammatically on Drawings.

G. Do not scale drawings.

H. Verify that utility services are available, of the correct characteristics, and in the correct locations. Failure to do so does not constitute a change order to the Work. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
   2. Furnish information to the Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

I. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

J. Notify Owner’s Representative in writing, immediately on discovery of errors, omissions, discrepancies and non-compliance with applicable codes and regulations within the documents or any work which will not fit, meet acceptable tolerances, or properly function if it were to be installed as indicated in the Contract Documents. Use Request or Information processes indicated outlined in Book 2. This item is in no way intended to relieve the Architect/Engineer of Record of design responsibility.

K. Start of work specified in each section indicates contractor's acceptance of conditions related to the work including existing construction and substrates.

3.02 PREPARATION

A. See Division 02 for requirements related to removal and waste management.

B. Clean substrate surfaces prior to applying next material or substance.

C. Seal cracks or openings of substrate prior to applying next material or substance.

D. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, or as requested by the Architect/Engineer of Record or Owner's Representative, or as required by the progress of the work, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section; including the following:

1. Contractor.
2. Owner's Representative.
3. Architect/Engineer of Record.
4. Installer's affected by the work.
5. Manufacturer's or Fabricator's Representatives affected by the work.
6. All participants shall be familiar with Project and authorized to conclude matters relating to the Work.

C. Prepare agenda and preside at meeting:
1. Review conditions of examination, preparation and installation procedures.
2. Review coordination with related work.
3. Review installation requirements with approved submittals.

D. Record minutes and distribute copies within 5 days of meeting, to participants and those affected by decisions made.

E. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and if necessary, reconvene the conference at earliest feasible date.

3.04 SURVEYING FOR LAYING OUT THE WORK

A. Verify locations of survey benchmark or control points prior to starting work.

B. Promptly notify Architect/Engineer of Record of any discrepancies discovered.

C. Protect survey benchmark or control points prior to starting site work; preserve permanent benchmark or control points during construction.

D. Promptly report to Architect/Engineer of Record the loss or destruction of any benchmark or control point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey benchmark control points based on original survey control. Make no changes without prior written notice to Architect/Engineer of Record.

F. Utilize recognized engineering survey practices.

G. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.

I. Periodically verify layouts by same means.

J. Maintain a complete and accurate log of benchmark, control, and survey work as it progresses. Make log accessible to Owner at all times.

K. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

L. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

M. Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Contractor is to provide equipment necessary for the completion of the work including equipment for hoisting and staging of materials.

D. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

E. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

F. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

G. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

H. Lay out required blocking, backings and grounds in concealed areas.

I. Install products at the time and under conditions that shall ensure the best possible results. Maintain conditions required for product performance until Preliminary Acceptance.

J. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

K. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/Engineer of Record.
   2. Allow for building movement, including thermal expansion and contraction.

L. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

M. Provide necessary access panels for work provided under the contract.

N. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

O. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

P. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 OWNER-INSTALLED PRODUCTS/WORK BY OTHER CONTRACTORS

A. Provide access to Project site for Owner's construction forces.

B. Coordinate construction and operations of the Work with work performed by Owner's construction forces.

C. Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

D. Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Board's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.07 ALTERATIONS

A. See Section 01 73 29 - Cutting and Patching

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions as necessary to protect Owner's property and operations.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Protect existing work to remain from damage or loss at all times during the execution of the Work. This includes all existing fixed, movable, or built-in furniture, equipment, and materials.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Protection of items to remain is to include all measures necessary to prevent any accumulation of dust, dirt, construction debris or any physical damage. The Contractor shall be responsible for the cost of any cleaning, repair, or replacement required due to inadequate protection.

3.08 SHORING, BRACING, AND SCAFFOLDING

A. Provide all shoring and bracing required for safety and the proper execution of the work. Install bracing and shoring so it does not interfere with the work of the Board or other Contractors.

B. Remove shoring and/or bracing that is no longer required.

C. Scaffolding - Provide and maintain scaffolding required in connection with the work. All scaffolding shall conform to the rules and regulations of all authorities having jurisdiction.

3.09 PROGRESS CLEANING

A. Contractor is to comply with all requirements of the City of Chicago Construction Site Cleanliness Ordinance as applicable to this project as well as any local jurisdictional requirements.
   1. Portions of the ordinance that become effective subsequent to the commencement of this Contract shall be followed from the time they become effective. No change orders shall be considered for work related to provisions of the Construction Site Cleanliness Ordinance or other local jurisdictional requirements.

B. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition. Clean debris outside of work area, including public spaces, which has resulted from construction activities.

C. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

D. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.

E. Clean areas of cutting and patching.

F. Collect and remove waste materials, debris, and trash/rubbish from site and work areas daily and dispose in dumpsters; do not burn or bury. Do not allow washed-down debris to enter sewers or waterways.
   1. All crates and boxes are to be dismantled or flattened before being placed in the container.
   2. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   3. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
   4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   5. See Division 02 for additional waste disposal requirements.

G. Provide and maintain all dumpsters and/or disposal boxes as may be required for the execution of the work. Dumpsters are to be immediately removed from the site when level full. Do not over-fill.
   1. Use of dumpsters and waste containers belonging to the Owner or User is strictly prohibited

H. Snow Removal: Remove snow and ice from the site and in all work areas for access, equipment, and material storage. This includes all fenced boundaries of the construction site and sidewalks. No salt or calcium chloride is to be used in snow and ice removal.

I. Maintain haul roads, public roads, stockpiles and paving areas that are used for construction operations free from any debris or damage.

3.10 PROTECTION OF INSTALLED WORK

A. Protect installed and existing work from damage by construction operations. Keep installed work clean.
   1. Comply with manufacturer's written instructions for temperature and relative humidity.

2. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended and that are not hazardous to health or property.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

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

H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer. Any damage resulting from roof leaks caused by roof operations shall be the responsibility of the Contractor.

I. Prohibit traffic from landscaped areas.

J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

K. Refinish or replace all damaged surfaces, assemblies, and equipment representing the finished work

L. Clean concealed areas before enclosing.

M. Supervise work to prevent damage to existing and installed construction.

3.11 SAFETY, SECURITY, AND FIRE PROTECTION

A. The Contractor is solely responsible for all safety and security at the project site. Assign a designated job safety person.

B. Conduct operations in accordance with all applicable regulations and requirements of local state and federal laws, including OSHA.

C. Provide safety protection, fall protection, barricades, warning signs, and coverings as required by the City of Chicago Building Code and Ordinance, applicable local Ordinance, OSHA or by the Owner. Maintain lights or signals as warning during the work, removing same when completed. Maintain MSDS/SD Sheets on site for products used in the work. Submit with close-out documents.

D. Replace protection, barriers, safety devices or warnings immediately upon completion of work requiring the removal of same or at the end of a working day should the work exceed one day.

E. Provide all safety equipment or weather protective gear required to perform the work including personal protective equipment such as eye, ear protection, and hard hats. Access to roofs shall be via use of properly anchored OSHA approved ladders.

F. Furnish all flagmen required for deliveries to the site.

G. Watchman Service: No watchmen will be provided. The Owner will not be responsible for a loss on account of theft of or damage to the property and/or equipment of any Contractor.

H. When working in the existing facility, lock and secure the premises at the end of the workday. Protect all work from damage, vandalism, and theft.

I. Fire Protection: Conform with all regulations for the City of Chicago Fire Department or local Jurisdictional Fire Department and of the Contractor's and Owner's Fire Insurance carrier for storage of flammable materials on site.

J. Provide blankets and auxiliary fire protection as required to prevent damage to adjacent work or materials as a result of welding, burning, or cutting by torch. Obtain Owner's approval of welding or torch work in the existing facility before starting.

K. Fire prevention facilities shall include fire extinguishers in adequate supply where flammable demolished materials accumulate and as otherwise required by OSHA and NFPA regulations.

3.12 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage. Adjust for proper operation.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. See Section 01 40 00 - Quality Requirements for additional requirements.

H. Start equipment and operating components and test to confirm proper operation. Remove damaged or malfunctioning units, replace with new units, and retest.

3.13 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. See Section 01 73 29 - Cutting and Patching for additional requirements.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

3.14 FINAL CLEANING

A. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial/institutional building cleaning and maintenance program.

B. Use cleaning materials that are nonhazardous. Comply with manufacturer's written instructions.

C. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire project or for a portion of project:
1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
2. Sweep paved areas broom clean and power wash to remove equipment marks. Remove petrochemical spills, stains, and other foreign deposits.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove tools, construction equipment, machinery, and surplus material from Project site.
5. Remove snow and ice to provide safe access to buildings.
6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
8. Sweep concrete floors broom clean in unoccupied spaces using sweeping compound or other non-dust producing product.
9. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
11. Clean washroom floor, walls, fixtures, toilet partitions, mirrors and etc with non- acid cleaning products and provide a sanitary condition.
12. Clean, mop all wood floors in areas of new construction and renovation work. Clean walls, woodwork in classrooms, offices and corridors.
13. Scrub tile floors in all food service areas and finish according to manufacturers’ specifications. Comply with requirements of CDPH and IDPH.
14. Clean resilient floors in accordance with manufacturer's written instructions for post installation initial cleaning. Use only manufacturer recommended products and materials. Seal floors as directed in product specifications.
15. Clean terrazzo floors in accordance with manufacturer's written instructions for post installation initial cleaning. Use only manufacturer recommended products and materials. Polish floors as directed in product specifications.

16. Remove labels that are not permanent. Do not remove "UL" labels and other similar identifiers including mechanical and electrical nameplates.
17. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
18. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
19. Replace parts subject to unusual operating conditions.
20. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
21. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
22. Clean ducts, blowers, and coils if units were operated without filters during construction.
23. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
24. Verify entire project area is clean and ready for occupancy.

D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

END OF SECTION 01 70 00

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cutting and patching of existing construction.

1.02 SUBMITTALS

A. Alterations to Existing Construction: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element or assembly
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of separate Contractor.

1.03 QUALITY ASSURANCE

A. General: Contractor shall take reasonable care prior to all cutting and drilling in order to minimize unintended damage to concealed conduits, cables, pipes, reinforcing steel, etc. In circumstances where the absence of such concealed elements is not established conclusively, utilize detection and mapping technology, e.g., X-ray or Sub-surface Interface Radar (SIR), to locate any such elements that may be present before proceeding with the cutting or drilling work.

B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio. Notify Architect of Record if progress of work may have structural impact.

C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Notify Architect of Record if progress of work may have operational impact. Operational Elements include the following:
   1. Air or smoke barriers.
   2. Fire-protection systems.
   3. Control systems.
   4. Communication systems.
   5. Conveying systems.
   6. Electrical wiring systems.
   7. Operating systems of special construction.

D. Miscellaneous Elements: Do not cut and patch building elements or related components in a manner that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Notify Architect of Record progress of work may have performance impact. Miscellaneous Elements include the following:
   1. Water, moisture, or vapor barriers.
   2. Membranes and flashings.
   3. Exterior curtain-wall construction.
   4. Equipment supports.
   5. Piping, ductwork, vessels, and equipment.
   6. Noise- and vibration-control elements and systems.

E. Physical Appearance: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect/Engineer of Record's opinion, reduce the building's aesthetic qualities.

1.04 FIELD CONDITIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated. Failure to do so does not constitute a change order to the Work.
   2. Report discrepancies to Architect/Engineer of Record before disturbing existing installation.
   3. Beginning of cutting and patching work constitutes acceptance of existing conditions.

1.05 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

A. New Materials: As specified in product sections; match existing adjacent products and work for patching and extending work.

B. Existing and In-Place Materials: Use materials identical to existing materials.
   1. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
   2. If identical materials are unavailable or cannot be used, use materials that, when installed, shall match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.01 GENERAL

A. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

3.02 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to prevent interruption of services to occupied areas.
   3. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   4. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   5. Verify that abandoned services serve only abandoned facilities.
   6. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
   7. If existing services to occupied areas must be interrupted, coordinate and receive approval of the interruption of services prior to starting work.

3.04 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
   2. Remove existing work as indicated and as required to accomplish new work.
   3. Prior to starting work in an area, make arrangements for moving of and subsequent reinstallation of any existing items which may conflict with the work area.
   4. Remove and replace existing walls and ceilings as required to facilitate installation of new work. Replacement of the existing walls & ceilings shall be coordinated as directed by the Architect/Engineer of Record and as delineated in the Contract Documents.
   5. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

6. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
7. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible.
1. Finish patched surfaces to match finish that existed prior to patching, unless noted otherwise. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Comply with installation requirements of individual sections.
4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
5. Restore work with new products in accordance with requirements of Contract Documents.
6. Where feasible test and inspect patched areas after completion to demonstrate integrity of installation.
7. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
8. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that shall eliminate evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
9. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

b. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material to full thickness of the penetrated element. Maintain designated fire rating of the wall, partition, ceiling, or floor construction.

10. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
11. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.05 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

B. Refinish, repair, or remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

END OF SECTION 01 73 29

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Sections
   1. City of Chicago Zoning Sustainability Requirements.
   2. Section 31 10 00 “Site Clearing” for disposition of waste resulting from site clearing and removal of above and below-grate improvements.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage / recycling of a minimum of 80 percent by weight of total waste generated by the Work. Practice

efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
    a. Asphalt paving.
    b. Concrete.
    c. Concrete reinforcing steel.
    d. Brick.
    e. Concrete masonry units.
    f. Wood studs.
    g. Wood joists.
    h. Plywood and oriented strand board.
    i. Wood paneling.
    j. Wood trim.
    k. Structural and miscellaneous steel.
    l. Rough hardware.
    m. Roofing.
    n. Insulation
    o. Doors and frames.
    p. Door hardware.
    q. Windows.
    r. Glazing.
    s. Metal studs.
    t. Gypsum board.
    u. Acoustical tile and panels.
    v. Carpet.
    w. Carpet pad.
    x. Demountable partitions.
    y. Equipment.
    z. Cabinets.
    aa. Plumbing fixtures.
    bb. Piping.
    cc. Supports and hangers.
    dd. Valves.
    ee. Sprinklers.
    ff. Mechanical equipment.
    gg. Refrigerants.
    hh. Electrical conduit.
    ii. Copper wiring.
    jj. Lighting fixtures.
    kk. Lamps.
    ll. Ballasts.
    mm. Electrical devices.
    nn. Switchgear and panelboards.
    oo. Transformers.
2. Construction Waste:
    a. Masonry and CMU.
    b. Lumber.
    c. Wood sheet materials.
    d. Wood trim.
    e. Metals.
    f. Roofing.
    g. Insulation.
    h. Carpet and pad.
    i. Gypsum board.
    j. Piping.

k. Electrical conduit.
l. Packaging: Regardless of salvage / recycle goal indicated in “General” paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
   1) Paper.
   2) Cardboard.
   3) Boxes.
   4) Plastic sheet and film.
   5) Polystyrene packaging.
   6) Wood crates.
   7) Plastic pails.
m. Construction Office Waste: Regardless of the salvage / recycle goal indicated in “General” paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
   1) Paper.
   2) Aluminum cans.
   3) Glass containers.

1.5 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.6 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.

1.7 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) in tons.
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
   8. Receiving point for waste that is recycled or otherwise diverted from landfill.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. 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.

G. City of Chicago Department of Zoning Sustainability Compliance Documentation to achieve City of Chicago Zoning Sustainability Requirement 8.1 80% Construction Waste Diversion:
   1. Contractor shall submit a signed letter committing to recycling or reusing at least 80% of the project's construction and demolition debris.
   2. Contractor shall complete and submit the City of Chicago Construction and Demolition Debris Recycling Compliance Form verifying at least 80% of the projects under construction or demolition waste was recycled or reused.

1.8 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements of Book 2.
   1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
   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.

1.9 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. 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, site-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 of 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 numbers.
3. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost / Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

E. Forms: Prepare waste management plans and logs on forms. All information/ content/categories in the sample forms included shall be in the final forms.
1. Contractor shall include all backup to information on forms.
2. Contractor to separate soils, landscape debris, environmentally impacted materials from total calculation.
3. Contractor shall define any and all materials marked as “inert”.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three 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.

D. 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 and recycled.
2. Comply with Section 01 50 03 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING 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.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 4-inch size.
1. Crush asphaltic concrete paving and screen to comply with requirements in Section 31 22 14 “Earthwork” for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
1. Pulverize concrete to maximum 4-inch size.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

C. Paint: Seal containers and store by type.

3.5 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill 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.

END OF SECTION 01 74 19

SECTION 02 13 15

SMALL SCALE DISTURBANCE OF ASBESTOS CONTAINING MATERIALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. These environmental requirements apply to all PBCC projects. These specifications apply for all demolition and construction activities that may include drilling, coring and/or anchoring into asbestos containing building materials or building materials assumed to contain asbestos but shall not disturb greater than a total of three (3) square feet or three (3) linear feet during the entire project work at the site.

B. Disturbance of small quantities of asbestos containing materials in interior building spaces, covered walkways or porticos connecting buildings, and on outdoor mechanical systems which condition indoor air (such as air handling units, air conditioners, cooling towers, etc.) is governed by rules established by the Illinois Department of Public Health (IDPH) and the Chicago Department of Public Health (CDPH). These specifications address or reference the requirements for complying with IDPH, CDPH, OSHA, and EPA NESHAP asbestos rules. Each and every rule requirement may not be restated in detail since trained, accredited, and licensed Contractors and individuals are required for this work and are presumed to be familiar with the relevant laws and rules. Full regulatory compliance is required, and is a part of the contract, whether specifically stated herein or not.

1.02 DEFINITIONS

A. In addition to the terms listed below, all definitions in the laws and regulations specified elsewhere in this Section are incorporated by reference, whether or not restated herein.

B. Abatement Contractor (AC): the entity responsible for performing the work in this Section, with the training and accreditation to competently perform the work. This entity shall obtain and maintain any licenses required for the work in this Section.

C. CDPH: the Chicago Department of Public Health.

D. Managing Environmental Consultant (MEC): the entity with overall responsibility for the environmental aspects of the project, including design, organization, direction, oversight and control as well as investigations, assessments, and supervision of project manager.

E. Environmental Project Manager (EPM): the person selected by the Managing Environmental Consultant to perform environmental monitoring and act on behalf of the PBCC or its agents on the project.

F. General Contractor (GC): the entity responsible for performing the complete scope of work in the Documents. The GC may elect to self-perform or subcontract out any portion of the work. If the GC acts as the AC, it must have the same credentials, training, accreditations and licenses required by the AC.

G. HEPA Filter: a High Efficiency Particulate Air filter capable of trapping 99.97% percent of particles greater than 0.3 micrometers in mass median aerodynamic equivalent diameter.

H. IDPH: the Illinois Department of Public Health.

I. OSHA: the federal Occupational Health and Safety Administration

J. Plasticize: to apply plastic sheeting over surfaces or objects to protect them from contamination or water damage.

K. SDS: Safety Data Sheets, required by OSHA for any chemical in the workplace that that could be expected to cause an exposure to workers during normal use or in emergency situations.

L. Work Area: areas where activities that disturb small quantities of asbestos containing materials are conducted.

M. Work Site: the room or rooms or routes for construction/distribution/mounting of the electrical systems undergoing activities covered by this section. All closets/book rooms/coat hanger rooms/vestibules/washrooms within a room are considered part of the work site in which work has been identified on the drawings, whether or not they are numbered/named separately. All other areas of the building (attics, basements, hallways, crawl-spaces etc) are considered part of the work site, even if they are not explicitly identified in the documents.

1.03 REFERENCE STANDARDS

A. The Contractor is responsible for compliance with all applicable local, state and federal laws, regulations and ordinances including, but not limited to, those listed below, which are incorporated by reference.

B. The following laws, regulations and standards are incorporated by reference:
1. 29 CFR 1910: US OSHA General Industry Standards
2. 29 CFR 1926: US OSHA Construction Standards
3. 40 CFR Part 61: USEPA National Emissions Standards for Hazardous Air Pollutants (NESHAP)
4. 77 Ill. Adm. Code 855 Rules for Asbestos Abatement for Public and Private Schools and Commercial and Public Buildings in Illinois.
5. 11-4-2170: Chicago Building Code- Demolition and renovation safeguards
6. 11-4-2150: Environmental standards related to the demolition, renovation, asbestos abatement and maintenance, sandblasting, chemical washing, and grinding of buildings, facilities or other structures

1.04 PROJECT CONDITIONS

A. The Work includes the control of dust emissions caused by construction, demolition, renovation, restoration, or related activities that disturb less than three square feet or three linear feet of asbestos containing materials including, but not limited to drilling sawing, cutting, grinding, sanding, abrading, sweeping, crushing, scraping, screwing into, or any other related processes. IN NO CASE CAN THE TOTAL QUANTITY OF DISTURBED ASBESTOS CONTAINING MATERIALS EXCEED THREE (3) SQUARE FEET THREE OR (3) LINEAR FEET FOR THE ENTIRE PROJECT AREA AND DURATION.

B. No visible emissions or unreasonable odors will be permitted within the work area.

C. All products/processes/equipment planned for use that will possibly cause emissions or odors shall be accompanied with SDS sheets and submitted to the AOR prior to the use of the product.

D. Use of licensed Asbestos Contractor and crew is required when building materials are confirmed to contain asbestos or assumed to contain asbestos.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. All tools and equipment shall at least conform to minimum industry standards and IDPH regulations.

B. Equipment:
   1. Negative Air Machines shall provide HEPA filtration and conform to ANSI Z9.2 fabrication criteria.
   2. Respirators shall be NIOSH approved for use with lead, asbestos, or other contaminants anticipated in the Work.
   3. Contractor is fully responsible for complying with OSHA rules for other Safety equipment, such as hard hats, safety harnesses, eye protection, gloves, footwear, and any other safety devices used on the site.
   4. Tools:
      a. Shovels and scoops shall be rubber or plastic, suitable for use in plasticized containment. Metal shovels are not permitted.
      b. Scrapers, brushes, utility knives and other hand tools shall be of good quality and suitable for the intended uses. The Contractor shall keep an ample supply on hand for the completion of the Work
      c. Power tools such as, but not limited to saws, pneumatic chisels, brushes, sanders, and needle guns shall be equipped with shrouds and HEPA-filtered local exhaust systems to capture released particles.

2.02 MATERIALS

A. All materials shall at least conform to minimum industry standards and IDPH regulations.

B. Installed materials which become a part of the Work such as, but not limited to, encapsulants shall be of good quality, non-lead-bearing, free of asbestos, and conform to the respective reinstallation specification sections prepared by others.
   1. Contractor shall ensure that encapsulants and sealants used as primers, basecoats, or covering existing materials are compatible with the respective existing or reinstallation materials and their manufacturers' warranties.
   2. Encapsulants for surfaces to which fireproofing shall be applied (beams, columns, floor or roof decks, other structural members) shall be tested and rated as a component of the fireproofing system and listed in the UL Fire Resistance Directory with the specific fireproofing material to be installed.

C. Abatement Materials:
   1. Fire-retardant Poly sheeting for all applications shall be 6 mil nominal thickness for critical seals, floors, ceilings and drop cloths, and 4 mil for walls.
   2. Tape shall be 2" or 3" duct tape or other waterproof tape suitable for joining poly seams and attaching poly sheeting to surfaces.
   3. Spray adhesives shall be non-flammable and free of methylene chloride solvents.
   4. Disposal bags shall be 6 mil.
   5. Disposable suits, hoods, and foot coverings shall be TYVEK or similar.
   6. Solvents shall be compatible with any primers, mastics, adhesives, paints, coatings, or other surfacing materials to be installed following their use.

PART 3 - EXECUTION

3.01 ASBESTOS WORK DETAILS

A. This specification section applies only to the disturbance of asbestos materials or materials assumed to contain asbestos in quantities less than three (3) square feet or three (3) linear feet. IN NO CASE CAN THE TOTAL QUANTITY OF DISTURBED ASBESTOS CONTAINING MATERIALS EXCEED THREE (3) SQUARE FEET OR THREE (3) LINEAR FEET FOR THE ENTIRE PROJECT AREA AND DURATION.

B. The Contractor is responsible for verifying quantities, conditions, and logistics in the field before bidding. Any questions about the scope or clarifications shall be obtained from the AOR prior to bidding. Any interpretations of the design documents shall only be made by the AOR.

C. The General Contractor and licensed Asbestos Contractor are responsible for security to the work area(s) during any activities covered by this Section.

D. Contractors and/or licensed Asbestos Contractors shall not move, disturb, displace or dispose of any assumed and/or confirmed asbestos containing ceiling tiles under this specification.

E. Any process that disturbs asbestos containing materials (assumed or confirmed) shall be conducted by a licensed Asbestos Contractor as detailed in IDPH Asbestos Regulation 855.330.

F. Contractor shall label bags and/or containers for asbestos waste with the following information:
   1. Generator Name
   2. Project Location
      a. Contractor shall secure sample of label and retain as part of daily log/final report.

G. The General Contractor and licensed Asbestos Contractor shall execute and provide to the MEC the required Waste Shipment Record (WSR) for any asbestos waste generated during Work provided under this specification. WSR shall be signed by the generator, transporter and landfill. All WSRs shall be returned to the PBCC within 30 days of transportation from the building.

H. Abatement Contractor shall submit to the MEC current IDPH Asbestos Contractor license and accreditation and items listed in Section 855.350 (d). All documents shall be provided to the MEC upon final acceptance of the work.

END OF SECTION

SECTION 02 24 01
ENVIRONMENTAL SCOPE SHEETS – BUSSE WOODS

FACILITY/PROJECT: Busse Woods Nature Preserve/Restroom Rehabilitation
STREET ADDRESS: 20 E. Higgins Road, Elk Grove, IL
PROJECT NO: 15050

DATE OF DOCUMENTS: September 20, 2024
ENVIRONMENTAL CONSULTANT: GSG Consultants, Inc.
EC PROJECT NO: No

LEAD-BASED PAINT (LBP) AREAS:
No LBP was detected at any of the sites within Busse Woods Nature Preserve.

ASBESTOS CONTAINING MATERIAL (ACM) & UNIVERSAL WASTE AREAS

The following tables identify the locations and types of ACM and Universal Waste encountered in the buildings at the Busse Woods Nature Preserve. If a site is not listed, no ACM and/or Universal Wastes were encountered.

Busse Forest Boat Center

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Window Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.
Metal	Vent Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.
Wood	Truss Caulk					X		ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes				X			Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Mercury-containing Gas Meters				X			Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect Mercury-containing Safety Switches				X			Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Elk Pasture

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes				X			Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect Mercury-containing Safety Switches				X			Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Forest Main Dam Grove #26

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes							Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Mercury-containing Gas Meters							Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Forest Main Dam Grove #27

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect Mercury-containing Safety Switches		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Forest Central Grove #4

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Window Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.
Metal	Vent Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Mercury-containing Gas Meters		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Ned Brown Grove #28

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Window Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Vent Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.
Wood	Truss Caulk					X		ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect Mercury-containing Safety Switches		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Reservoir Grove #17

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Window Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Vent Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.
Wood	Truss Caulk					X		ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes		x					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect Mercury-containing Safety Switches		x					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Forest West Grove #31

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Exterior Door Caulk			X				ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Window Caulk		X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electric Boxes		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Mercury-containing Gas Meters		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Busse Reservoir Dock Grove #24

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Window Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.
Metal	Vent Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Wood	Truss Caulk					X		ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect PCB-Containing Electrical Boxes		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	Suspect Mercury-containing Safety Switches		X					Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

END OF SECTION

SECTION 02 24 01

ENVIRONMENTAL SCOPE SHEETS – DAN RYAN WOODS

FACILITY/PROJECT: Dan Ryan Woods Nature Preserve/Restroom Rehabilitation
STREET ADDRESS: 2400 W. 87th Street, IL
PROJECT NO: 15050

DATE OF DOCUMENTS: September 20, 2024
ENVIRONMENTAL CONSULTANT: GSG Consultants
EC PROJECT NO: No

LBP AREAS:
No LBP was detected at any of the sites within Dan Ryan Woods Nature Preserve.

ASBESTOS CONTAINING MATERIAL (ACM) & UNIVERSAL WASTE AREAS

The following tables identify are the locations and types of ACM and Universal Waste encountered in the buildings at the Dan Ryan Woods Nature Preserve. If a site is not listed, no ACM and/or Universal Wastes were encountered.

Dan Ryan Woods Grove #16

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Potential PCB-Containing Fluorescent Light Ballasts					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Dan Ryan Woods Grove #4

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Vent Caulk	X	X	X	X			ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Potential PCB-Containing Fluorescent Light Ballasts					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Dan Ryan Woods Grove #9 (Visitor Center)

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Potential PCB-Containing Fluorescent Light Ballasts					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	“Exit” signs and Back-up Batteries					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Dan Ryan Woods Grove #2

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Potential PCB-Containing Fluorescent Light Ballasts					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

Dan Ryan Woods Grove #10

ACM

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Transite					X		ACM Removal and disposal	Removal, if necessary, to be performed in accordance with specification section 02 82 14.

Universal Waste

Substrate	Component	Walls				Ceiling	Floor	Response Action	Comments
		N	E	S	W	C	F		
Metal	Potential PCB-Containing Fluorescent Light Ballasts					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.
Metal	4-foot fluorescent light bulbs					X		Removal and proper disposal	If removal/ disposal is necessary, refer to specification section 02 86 13.

END OF SECTION

SECTION 02 26 00

HAZARDOUS MATERIALS ASSESSMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This environmental summary is for information purposes only. No work is associated with this section.

1.02 AVAILABLE ENVIRONMENTAL ASSESSMENT DOCUMENTS

A. Hazardous Building Materials Survey Report – Busse Woods September 2024

B. Hazardous Building Materials Survey Report – Dan Ryan Woods September 2024

1.03 SITE DESCRIPTION

A. Busse Woods Nature Preserve
1. The site consisted of nine (9) separate restroom buildings throughout the park. Each building is a one-story restroom facility for males and females. Building exteriors are brick, and interior walls are cinderblock, with tile floors.
   a. Busse Forest Grove #31
   b. Busse Forest Grove #4
   c. Busse Forest Grove #27
   d. Busse Forest Grove #26
   e. Busse Forest Elk Pen
   f. Busse Forest Boating Center
   g. Busse Forest Grove #24
   h. Busse Forest Grove #17
   i. Busse Forest Grove #28

B. Dan Ryan Woods
1. The site consisted of five (5) separate restroom buildings throughout the park. Each building, with the exception of the restrooms in the Visitor Center) is a one-story restroom facility for males and females. Building exteriors are brick, and interior walls are cinderblock, with tile floors.
   a. Dan Ryan Woods Grove #16
   b. Dan Ryan Woods Grove #4
   c. Dan Ryan Woods Grove #9 (visitor center)
   d. Dan Ryan Woods Grove #2
   e. Dan Ryan Woods Grove #10

1.04 ENVIRONMENTAL CONDITIONS

A. Each of the two (2) Project Areas are public forest preserve parks. The specific buildings within each Project Area are utilized as public restrooms. The purpose of the work ranges from accessibility upgrades, repairs to damaged components including replacement of flooring, lighting, damaged plumbing fixtures and accessories, to full aesthetic upgrades which include replacing all plumbing fixtures, interior partitions, doors, paint as well as minor sidewalk modifications adjacent to the facility.

B. GSG Consultants performed a pre-demolition asbestos-containing material (ACM) and hazardous material surveys at the various restrooms. The ACMs identified included door, truss, vent, and window caulk, transite soffit/ceiling materials, and mudded joint packing

C. The hazardous materials identified during the survey included fluorescent bulbs, ballasts, mercury thermostat, and mercury safety switches.

D. The lead-based paint sampling did not identify any components as being coated with lead-based paint at any of the locations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements indicated and specified, and as required for installation of new work required for the completion of the project.

1.02 RELATED REQUIREMENTS

A. Section 00 01 11 – Supplemental Project Information: Contractor to review all available information about known hazardous materials.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

B. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.04 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them in accordance with Division 31 Sections, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction, where indicated, and deliver to designated location ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Contractor to confirm abatement of hazardous materials and asbestos containing materials prior to demolition activities.

B. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
      a. Require attendance by all affected installers including but not limited to
         1) Contractor's Superintendent
         2) Installer
         3) Manufacturer/Fabricator Representative
         4) Other affected Subcontractors

5) Professional of Record
6) Owner's Representative

3. Review the scope of work, inspect and discuss condition of construction areas to be selectively demolished.
4. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
6. Review areas where existing construction is to remain and requires protection.
7. Record minutes and distribute copies within 5 days after meeting to participants as well as Professional of Record, Owner's Representative and those affected by decisions made.

C. Materials Ownership: The drawings indicate plumbing fixtures that FPDCC wishes to maintain ownership of for future use. Such items shall be removed, salvaged, cleaned, and delivered to an off-site location. Items shall be carefully removed in a manner to prevent damage and promptly delivered to the board.
1. Deliver crated materials, with inventory record of contents to: 2199 S. First Avenue Maywood, IL 60153. Obtain a record receipt by FPDCC staff confirming that materials arrived undamaged.

1.06 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Schedule of Selective Demolition Activities: Indicate the following:
1. For purposes of Owner's information only, sequence of selective demolition and removal work, with starting and ending dates for each activity as well as shift starting and ending times. Ensure Owner's on-site operations are uninterrupted as well as the work of other Contractors working on site.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of proposed dust- and noise-control temporary partitions and means of egress.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner and other Contractor's partial occupancy of ongoing and completed Work.
6. Means of protection for items to remain in the building and items in path of waste removal from building.
7. Path of waste removal from building and locations of waste containers.

C. Pre-demolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, that might be misconstrued as damage caused by building demolition operations. Submit before beginning work on this section.

D. Liquid Materials Handling Plan: Prior to commencing work, the Contractor shall provide a liquid materials handling plan. The plan shall stipulate provisions for dewatering, pumping, collection, temporary storage, and discharge or disposal of storm water, perched water and other liquids, contained and /or uncontained, at the site so as to facilitate removal of materials from the site and minimize disposal costs for contained materials.

E. Landfill Records: Provide disposal receipts and acceptance of wastes from the permitted Subtitle D Landfill to The Project Site.

1.07 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with all governing environmental regulations prior to and during demolition. Comply with requirements of authorities having local, state and federal jurisdiction and the City of Chicago. Comply with all requirements related to lead paint; asbestos containing materials; PCB's; universal and hazardous materials; environmental dust control; health related hazards; and air, water, and ground quality. Comply with requirements for the management and legal disposal of waste materials.

D. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.08 FIELD CONDITIONS

A. Conditions existing at the time of inspection for bidding purposes will be maintained by the Cook County Forest Preserve insofar as practicable.

PART 2 - PRODUCTS -- NOT USED

PART 3 - EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Verify that area to be demolished is vacated and use discontinued prior to the start of the Work.

B. Take precautions to prevent catastrophic or uncontrolled collapse of existing construction being removed and to remain do not allow worker or public access within range of potential collapse of unstable construction.
   1. Engage a demolition engineer to perform an engineering survey of existing conditions of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
   2. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction and finishes to remain. Strengthen or add new supports when required during progress of demolition

C. Other Contractor's performing work under other contracts will occupy portions of the building immediately adjacent to selective demolition area(s). Conduct operations to minimize effects on and interference with adjacent structures and occupants. Coordinate shared access and occupancy through the Owner's representative.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

D. Provide, erect, and maintain temporary barriers and security devices necessary for execution of the work and to protect Owner's property and operations. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 - Temporary Facilities and Controls and Section 01 56 11 - General Dust, Fume, and Odor Controls.

E. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
1. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

F. Start work under this section only after asbestos and/or hazardous materials have been removed in accordance with Related Sections.

G. If hazardous materials are discovered during removal operations, notify the Owner's Representative. Start of operations will be evidence of acceptance that environmental conditions have been remedied in accordance with applicable Division 2 and Division 31 Sections, and Environmental Manual.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.

3.02 EXISTING UTILITIES

A. Maintain existing utilities required to remain in service and protect them against damage during selective demolition operations.

B. Maintain existing fire-protection facilities in service during selective demolition operations.

C. Inspect the facility for the presence of special systems that must be maintained operational during demolition in the presence of the Owner. Such systems include security systems, access control systems, fire and smoke detection and alarm systems and communication systems.
1. Develop a strategy with the Owner's Representative to maintain such systems operational during alterations including temporary re-working, unavoidable downtime, acceptable discontinuation of service intervals and contingencies for notification of involved agencies.
2. Instruct every Subcontractor as to the procedures to be followed and supervise the process to ensure implementation.
3. Restore such systems and extend them into the altered area.
4. Include all services and materials necessary to maintain special systems in the Contract Sum.

D. Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.03 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and coordinate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect of Record.

E. Record existing conditions by use of preconstruction photographs and preconstruction videotapes.
1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.04 SELECTIVE DEMOLITION

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Professional of Record before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated on drawings and as required to accomplish new work. Remove existing construction only to the extent required by new construction.

C. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.
5. Where possible Items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete

D. Use methods required to complete the selective demolition work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
   a. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site at a permitted Subtitle D landfill facility.
6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials at a permitted Subtitle D landfill promptly.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI (RWP) .
   1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI (RWP).

E. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.06 MANAGEMENT OF DEMOLISHED MATERIALS

A. Separate recyclable demolished materials from other demolished materials to the maximum extent possible. Separate recyclable materials by type.
   1. Provide containers or other storage method for controlling recyclable materials until they are removed from Project site.
   2. Stockpile processed material on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from demolition area. Do not store within drip line of existing trees to remain.
   4. Store recyclable and salvaged components off the ground and protect from the weather.

B. For items indicated to be Removed and Salvaged:
   1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner's Representative.
5. Protect items from damage during transport and storage.

C. For items indicated to be Removed and Reinstalled:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.07 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site immediately. Legally dispose of non-recyclable debris, and other materials resulting from demolition operations in accordance with Division 31 Sections as applicable.

B. Burning of removed materials will not be permitted on the site.

C. Sale of removed materials will not be permitted on the site.

D. Remove from site all materials not to be reused on site; do not burn or bury. Comply with requirements in Division 31.

E. Leave site in clean condition, ready for subsequent work.

F. Clean up spillage and wind-blown debris from public and private lands.

G. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began

END OF SECTION 02 41 19

SECTION 02 82 13

ASBESTOS ABATEMENT - PRIOR TO DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. These environmental requirements apply to all PBCC projects. These specifications apply for all demolition, construction and renovation projects that require the removal and disposal of asbestos containing materials prior to the demolition of a building in accordance with all applicable regulations.

1.02 PROJECT CONDITIONS

A. Asbestos abatement work prior to demolition is required to follow all applicable Local, State and Federal regulations. This specification is intended to provide for the removal of friable and Category I and II non-friable asbestos-containing materials prior to a structural demolition. Abatement of these items is specified in the specifications. When only a portion of the structure is being demolished, related paragraphs in Division 02 Section "Interior Abatement - Interior" may be referenced or included for barrier walls or related ACM in the areas to remain.

1.03 DEFINITIONS

A. In addition to the terms listed below, all definitions in the laws and regulations specified elsewhere in the specifications are incorporated by reference, whether or not restated herein.

B. Abatement Contractor (AC): the entity responsible for performing the work in the specifications and has the training and accreditation to competently perform the work. This entity shall obtain and maintain licenses required for the indoor work in the specifications.

C. ACM: Asbestos Containing Material.

D. Architect of Record (AOR): any person or firm employed by the PBCC for the purpose of designing the project.

E. Asbestos Abatement Supervisor (Supervisor): any person who supervises asbestos abatement workers. This person must be trained, accredited, and meet OSHA competent person criteria for asbestos abatement.

F. CDPH: Chicago Department of Public Health.

G. Competent person: one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f): in addition, for roofing materials (considered Class II work) who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent.

H. Contractor: the entity responsible for performing the complete scope of work in the documents. The Contractor may elect to self-perform or subcontract out any portion of the work.

I. Drawings: Any drawings and sketches referenced by Contract or incorporated into the Contract by a bulletin issued by the AOR or Change Order as the Work progresses

J. Managing Environmental Consultant (MEC): the entity with overall responsibility for the environmental aspects of the project, including design, organization, direction, and control as well as investigations, assessments and on-site supervision of project managers.

K. Environmental Project Manager (EPM) is the project manager selected by the MEC to perform environmental monitoring and act on behalf of the MEC for the PBCC on the project.

L. HEPA Filter: a High Efficiency Particulate Air filter capable of trapping 99.97% percent of particles greater than 0.3 micrometers in mass median aerodynamic equivalent diameter.

M. IDPH: the Illinois Department of Public Health.

N. OSHA: the federal Occupational Health and Safety Administration.

O. Plasticize: to apply plastic sheeting over surfaces or objects to protect them from contamination or water damage.

P. Personal Protection Equipment (PPE): the protective suits, head and foot covers, gloves, respirators and other items used to protect persons from asbestos or other hazards.

Q. PBCC: Public Building Commission of Chicago, the Owner of the property and the authority ordering the work specified herein.

R. PBCC Representative: the entity responsible for overall project coordination and completion.

S. RCRA: the Resource Conservation and Recovery Act and associated regulations.

T. SDS: Safety Data Sheets, required by OSHA for any chemical in the workplace that that could be expected to cause an exposure to workers during normal use or in emergency situations.

U. TCLP: the Toxicity Characteristic Leaching Procedure as specified in EPA 530/SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods 3rd edition, November 1986.

V. User: means the entity for which or on whose behalf the PBCC has undertaken to cause the Work to be performed.

W. Work: the obligations of the Contractor under the Contract Documents. Work includes, unless specifically excepted by the Contract Documents, the furnishing of all materials, labor, equipment, supplies, plant, tools, scaffolding, transportation, superintendence, permits, inspections, occupancy approvals, insurance, taxes, and all other services, facilities and expenses necessary for the full performance and completion of the requirements of the Contract Documents. Work also means that which is furnished, produced, constructed, or built pursuant to the Contract Documents.

X. Work Area: the area or areas where asbestos abatement is being conducted.

1.04 SCOPE OF WORK.

A. Refer to Contract Drawings and Environmental Scope Sheets in Section 02 24 01.

B. The Work includes all labor, equipment, materials, and supplies necessary to perform the scope of work in the documents by the procedures described herein. The Contractor, by submitting a

bid for the Work, represents itself as knowledgeable and expert in the performance of the Work, and includes all things usually and customarily necessary to provide a complete and finished job, whether specifically mentioned or not.

C. Removal of friable and non-friable asbestos-containing materials listed in the documents, including isolating the Work Areas, protection of adjacent areas, cleanup, proper packaging and disposal of wastes, and all other steps necessary to complete the scope of work.

D. Repair or replacement of damaged surfaces, fixtures, or furnishings in portions of the structure that will not be demolished, if any, to restore them to their pre-existing condition to the satisfaction of the PBCC Representative.

E. Compliance with all applicable laws, regulations, standards, and these specifications. In the case of a conflict, the Contractor shall comply with the most stringent.

F. All licenses, accreditations, permits, fees, notifications, reports, or other documents required by law, regulation, this specification, or the documents.

G. Provide project closeout documentation to the EPM within thirty (30) days after final clearance. This documentation shall include, but is not limited to, submittals requirements specified elsewhere in the specifications.

1.05 LAWS, REGULATIONS AND STANDARDS

A. The following laws, regulations, and standards are incorporated by reference:
1. 29 CFR 1910: US OSHA General Industry Standards
2. 29 CFR 1926: US OSHA Construction Standards
3. 29 CFR 1926.1101: US OSHA Asbestos Construction Standards
4. 40 CFR Part 61: US EPA National Emissions Standards for Hazardous Air Pollutants (NESHAP), 11/90 revision
5. 40 CFR 763 Subpart E, US EPA Asbestos Model Accreditation Plan (MAP): Appendix C - Interim Final Rule
6. 11-4-2170: Chicago Building Code - Demolition and renovation safeguards
7. 11-4-2150: Environmental standards related to the demolition, renovation, asbestos abatement and maintenance, sandblasting, chemical washing, and grinding of buildings, facilities and other structures.

1.06 ASSESSMENT, MONITORING, TESTING AND ANALYSIS

A. The MEC will perform inspection, testing and design services prior to the start of work, and monitoring during the project and upon its completion:
1. Prior to the start of work, the MEC shall:
   a. Verify the PBCC has notified the appropriate regulatory agencies of the decommissioning of the building(s).
   b. Identify suspect materials and confirm their asbestos content through review of the previous investigations or by testing.
   c. Design the project and address any design changes as requested. EPM and Air Sampling Professional changes shall be submitted to the IDPH.
   d. Collect background air samples before conditions are disturbed. Background samples shall be analyzed by PCM.
   e. During the work, the MEC shall:
      1) Observe the work with sufficient frequency to ensure contractor compliance with the specifications.

2) Assure that all personnel and visitors have the proper current medical screening, respirator fit test, and training for their respective duties prior to entering a regulated area.
3) Collect air samples in and around the Work Area, as needed, to verify exposure conditions.
4) The MEC may stop the work if airborne asbestos concentrations at the Work Area perimeter exceed 0.01 f/cc. Contractor shall be responsible for taking corrective action to reduce exposure levels and prevent recurrence, and cleaning adjacent areas that become contaminated by the asbestos abatement activities.

f. Upon completion of the work, the MEC shall:
1) Visually inspect for visible debris. Contractor shall be required to re-clean the area or potions of areas until no visible debris remains.
2) Conduct final clearance testing as required.
3) Prepare the project report.

B. The Contractor shall provide OSHA compliance air monitoring to determine exposures to its employees in accordance with OSHA 29 CFR 1926.1101. Frequency of testing shall comply with OSHA requirements for the anticipated and actual exposure levels.
1. A written Exposure Assessment may be provided prior to the start of the work to determine the requirements for respiratory protection and frequency of OSHA monitoring for each type of activity. The contractor should note that a Negative Exposure Assessment (NEA) may be possible for many tasks.
2. Analysis may be performed on site.

C. Credentials required for testing and analysis of PCM air samples:
1. Accreditation by AIHA or AAR; or
2. Participation in the Proficiency Analytical Testing (PAT) program.
3. Certification of individual qualification to read samples on site when on site analysis is conducted.

1.07 SUBMITTALS

A. THE FOLLOWING SHALL BE SUBMITTED TO THE MEC NO LESS THAN 10 DAYS PRIOR TO THE START OF THE ASBESTOS ABATEMENT ACTIVITIES.

B. Ten (10) day NESHAP notification to the Illinois EPA when the asbestos quantities reach or exceed 260 linear feet or 160 square feet. Two (2) day IDPH notification for asbestos abatement quantities less than 260 linear feet or 160 square feet. Submit ten (10) day notification to CDPH for all asbestos work.
1. Ten (10) day IEPA Asbestos Notification on revised form, including inspector license number and landfill permit number.
2. Evidence that all contractor employees in the Work Areas are trained and accredited in accordance with OSHA, NESHAP, and EPA MAP requirements:
a. Current Annual refresher training certificate.
b. Current IDPH asbestos license (optional, in lieu of initial training certificate).
c. Current physicians written opinion.
d. Current respirator fit test for negative pressure respirators when respirators are used.
e. Copy of OSHA exposure assessment, if available.
f. OSHA compliance air monitoring records generated during the project.
g. Waste shipment records.
h. Worker license and certification log.
i. Safety Data Sheets (SDS) for chemicals used on site.
j. Work plan and schedule.

C. Prior to beginning work, the AC shall submit required notifications to applicable regulatory agencies and receive an Owners Authorization and Notice to Occupants from the PBCC for buildings where asbestos abatement will take place. The AC shall provide copies of all regulatory notices to the PBCC's Representative, the MEC, and the EPM within 24 hours of sending such notices to the regulatory authority. The AC shall not begin a project until such notices are provided to the Board and the EPM.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. All tools and equipment shall at least conform to minimum industry standards and IDPH regulations.

B. Equipment:
1. Negative Air Machines shall provide HEPA filtration and conform to ANSI Z9.2 fabrication criteria.
2. Respirators shall be NIOSH approved for use with lead, asbestos, or other contaminants anticipated in the Work.
3. Contractor is fully responsible for complying with OSHA rules for other safety equipment, such as hard hats, safety harnesses, eye protection, gloves, footwear, and any other safety devices used on the site.
4. Pressure differential manometer with readable tape shall be provided by the Contractor including calibration documentation.

C. Tools:
1. Shovels and scoops shall be rubber or plastic, suitable for use in plasticized containment. Metal shovels are not permitted.
2. Scrapers, brushes, utility knives and other hand tools shall be of good quality and suitable for the intended uses. The Contractor shall keep an ample supply on hand for the completion of the Work.
3. Power tools such as, but not limited to saws, pneumatic chisels, brushes, sanders, and needle guns shall be equipped with shrouds and HEPA-filtered local exhaust systems to capture released particles.

2.02 MATERIALS

A. All materials shall at least conform to minimum industry standards and IDPH regulations.

B. Abatement materials:
1. Fire-retardant, poly sheeting for all applications shall be 6 mil nominal thickness for critical seals, floors, ceilings and drop cloths, and 4 mil for walls.
2. Tape shall be 2” or 3” duct tape or other waterproof tape suitable for joining poly seams and attaching poly sheeting to surfaces.
3. Spray adhesives shall be non-flammable and free of methylene chloride solvents.
4. Disposal bags shall be 6 mil.
5. Disposable suits, hoods, and foot coverings shall be TYVEK or similar.
6. Solvents shall be compatible with any primers, mastics, adhesives, paints, coatings, or other surfacing materials to be installed following their use.

PART 3 - EXECUTION

3.01 EMPLOYEE TRAINING, QUALIFICATION AND MEDICAL SCREENING

A. Supervisors and Workers shall be trained, accredited, and licensed in accordance with IDPH rules.
   1. Contractor shall keep copies of licenses, initial training course certificate, and most recent annual refresher training certificate at the jobsite at all times for all contractor personnel.
   2. A Supervisor (competent person) shall be present at the worksite at all times when work under the specifications is being conducted.

B. Medical Screening. All contractor personnel shall have a current medical examination in accordance with OSHA requirements. Copies of the Physician's Written Opinions shall be kept on site.

3.02 PERMISSIBLE EXPOSURE LIMITS

A. The OSHA Permissible Exposure Limit (PEL) for worker exposure to airborne asbestos is 0.1 f/cc as an 8-hour time-weighted average (TWA).

B. The OSHA short term excursion limit for worker exposure to airborne asbestos is 1.0 f/cc for a 30 minute sample.

3.03 EXPOSURE ASSESSMENT AND MONITORING

A. The Contractor shall make a written assessment of the potential airborne asbestos fiber exposures for this project. Assessments shall conform with OSHA requirements and may be based upon:
   1. Initial monitoring of representative workers who the contractor believes are exposed to the greatest airborne concentrations of asbestos, or
   2. Past monitoring (within the past 12 months) or objective data for conditions closely resembling the processes, type of material, control methods, work practices and environmental conditions to be used for this project.

B. The Contractor shall perform personal monitoring in accordance with the following requirements:
   1. Initially, to establish an exposure assessment when past monitoring or objective data are not available for an initial determination.
   2. Periodically if the exposures are, or are expected to be, below the PEL.
   3. Daily, if exposures are above the PEL.
   4. Whenever there has been a change of equipment, process, control, personnel, or a new task has been initiated that may affect employee exposures, the exposure assessment shall be updated, and monitoring shall be re-instituted if exposures are unknown or are expected to exceed the PEL.

3.04 RESPIRATORY PROTECTION

A. Respiratory protection shall be worn in accordance with all applicable regulations referenced in Laws, Regulations and Standards specified elsewhere in the specifications.

3.05 HYGIENE PRACTICES

A. Eating, drinking, smoking, chewing gum or tobacco, and applying of cosmetics are not allowed in the Work Area.

B. All persons entering the Work Area are required to wear appropriate PPE, and follow the entry and exit procedures posted in the Personnel Decontamination Enclosure System.

C. Personal Protection Equipment (PPE) is required when airborne exposures are, or are expected to be above the PEL, or as needed to protect the safety of personnel and visitors. PPE may include:
1. Full body disposable suits, headgear, and footwear.
2. Gloves.
3. Hardhats.
4. Non-disposable footwear and clothing shall remain in the Work Area and shall be disposed of as contaminated waste when the job is completed.
5. Authorized visitors shall be provided with suitable PPE when PPE is required in the Work Area. The EPM shall assure that visitors have proper and current medical screening and fit test, and awareness training or other appropriate training.
6. A Personnel Decontamination Facility is required when worker exposures are expected to exceed the PEL. The decontamination unit may be remotely located if not feasible to locate adjacent to the Work Area.
    a. When a remote decon unit is used, personnel shall use a double-suiting procedure for traveling between the Work Area and the decon. Persons shall HEPA-vacuum the exterior of their disposable suits at the entry to the Work Area, put on a clean suit over the existing suit, and proceed to the decon unit for shower decontamination and change into street clothes.
7. When exposures are below the PEL, protective disposable suits are recommended, but not required. To exit, persons shall HEPA-vacuum down clothing at the Work Area entry, and leave the Work Area. When disposable suits are used, they shall be HEPA-vacuumed, stripped off, and deposited in an asbestos disposal bag. Personnel may then leave the Work Area.

3.06 PROHIBITED ACTIVITIES

A. Dry removal or dry sweeping, except:
1. During freezing weather. In this case, temperature and weather conditions must be recorded at the start, during, and at the end of the shift.
2. On roofs with 3:1 slope or greater. In this case, roofing shall be removed in an intact condition, as much as possible.
3. For roofing areas of less than 25 square feet.
4. When equipment damage or other hazard exists. In this case, written permission from IEPA is required prior to performing dry removal.

B. Use of compressed air for cleaning.

C. Use of high speed power tools not equipped with a HEPA-filtered local exhaust or water spray system.

D. Removing respirators or other PPE in the Work Area.

E. Contractor shall not salvage or recycle building materials unrelated to abatement scope of work.

3.07 WORK AREA ISOLATION AND PREPARATION

A. General Preparation. Contractor shall:
1. Post:
    a. Caution signs meeting the specifications of OSHA 29 CFR 1926.1101 (k)(6) at any location and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels.

b. Decontamination and work procedures in equipment rooms and clean rooms.
c. EPA NESHAP asbestos rules (40 CFR Part 61, subparts A & M) in the clean room.
d. OSHA Asbestos Construction Standards (29 CFR 1926.1101) in the clean room.
e. List of telephone numbers in the clean room for:
   1) Local hospital and/or local emergency squad.
   2) Owner representative reachable 24 hours per day.
   3) Contractor's headquarters.
   4) Architects or consultants directly involved in the project.
f. Secure the Work Area from entry by unauthorized persons.

2. Exterior Preparation:
   a. 6 mil plastic sheeting shall be placed over the ground, foundation, or other surfaces below the abatement area.
   b. Unauthorized entry shall be prevented by using appropriate barriers, such as warning tape, fencing, or other suitable barriers.
   c. Nearby air intakes, grilles, and other openings into the building interior areas not being demolished above, below, or besides the Work Area that could be exposed to airborne dust shall be closed or sealed off with poly and tape.
   d. All electric power in the Work Area shall be protected with ground-fault circuit interrupters.

3.08 ABATEMENT PROCEDURES

A. General Removal Requirements:
   1. Asbestos materials shall be wetted and kept wet during removal.
   2. ACM shall be bagged or containerized as it is removed. Wastes shall not be dropped or thrown to the ground. Unless the material is carried or passed to the ground by hand, it shall be lowered via covered, dust-tight chute, crane, hoist, or other means that prevent the wastes from being dropped or thrown.
   3. Appropriate OSHA fall protection shall be provided when appropriate:
      a. Scaffolding more than one section high shall be equipped with handrails and mid-rails designed to provide fall protection, or full-body safety harnesses shall be worn and tied off to a secure anchor point.
      b. Workers in man-lifts shall wear full body harnesses and tie to the tie-off point provided on the man-lift basket whenever the basket is elevated from ground level.
      c. Personal fall protection consisting of full body harnesses, lanyards, and OSHA-compliant lifelines, anchorage, and deceleration devices shall be provided whenever personnel are within 6 feet of an opening, hole, or edge where there is a risk of falling 6 feet or more.
   4. Roofing:
      a. General: Remove in an intact state to the extent feasible. ACM roof mastics, cements, underlayments, and flashings. Asbestos-containing shingles may occasionally break even when removed carefully. The fact that otherwise intact roofing materials become separated or broken does not by itself render them non-intact. However, if they become pulverized, reduced to powder or dust, they have become non-intact.
         1) The Contractor shall take care to minimize the amount of roofing material damage.
         2) If the materials are rendered non-intact, the AC shall employ methods to contain the dust and debris and utilize hygiene practices appropriate for friable (OSHA Class I) ACM, including PPE, decontamination units, and monitoring. Monitoring may include area samples at the Work Area perimeter to determine that airborne asbestos fibers are not being released in concentrations above the PEL.
      b. Built-up roofing and asphalt shingles:
         1) Power cutting machines shall be equipped with a HEPA-filtered dust collection system or shall be misted during use.

2) Dust generated by the cutting operation shall be collected with HEPA vacuums or wet cleaning methods.

c. Rigid roofing materials, such as cement asbestos shingles: remove intact and minimize breakage.

5. Transite, Galbestos sheeting (galvanized metal with a baked-on asbestos paint), Asbestos/Cement pipe, or other rigid panels shall be removed using wet methods.

6. Other:

a. Coatings, electric cable insulation or joint coverings, and other miscellaneous materials that are to be removed with the substrate or that can be removed without becoming friable may be removed as intact (OSHA Class II, EPA NESHAP Category I or II non-friable) in accordance with procedures described in General Removal Requirements and Roofing paragraphs above.

b. Coatings, and other miscellaneous materials that must be removed from the substrate or that otherwise shall become friable must be removed as non-intact (OSHA Class I, EPA NESHAP friable) in accordance with procedures described in General Removal Requirements and Roofing paragraphs above.

3.09 CLEANING AND DECONTAMINATION

A. All visible accumulations of ACM, debris, tools, and unnecessary equipment shall be removed from the Work Area.

B. Protective poly shall be folded in on itself, rolled up, placed in asbestos disposal bags, and disposed as asbestos waste.

C. Surfaces which have been exposed to friable ACM or its dust shall be HEPA vacuumed.

D. Dry sweeping of surfaces that have been exposed to friable ACM or its dust is not permitted.

3.10 FINAL CLEARANCE

A. Cleaning may be discontinued when there is no visible debris and area air monitoring results verify that exposures are below the PEL.

B. Final (aggressive) clearance sampling will be conducted by the EPM. Each sample result, as determined by Phase Contract Microscopy, shall be less than or equal to 0.01 f/cc. If the sampling results indicate a concentration of airborne fibers in excess of this clearance criteria, the contractor shall re-clean the contained and/or regulated area. The Contractor shall not be released until the contained and/or regulated Work Area meets the clearance criteria.

3.11 WASTE DISPOSAL AND EQUIPMENT LOAD-OUT

A. Category I and II non-friable waste may be adequately wetted and loaded in bulk into lined receptacles, such as dumpsters or trailers. Receptacles shall be closeable and lockable to provide security and to prevent air emissions. It is the abatement contractor's responsibility to determine and provide for more stringent manifesting or packaging requirements that may be imposed by transporters or landfills.

B. Packaged friable asbestos wastes:

1. Asbestos-containing wastes, including removed ACM and debris, poly, critical barrier materials, suits, respirator filters, vacuum HEPA filters, water filters, and other asbestos-containing items shall be properly packaged for disposal.
2. Use 6 mil plastic bags with a gooseneck seal, drums, or other type of sealed container.
3. Wrap large or irregular items in 6 mil poly sheeting and seal with tape.

4. Sharp, jagged, or other items that may puncture poly shall be packaged in rigid impermeable containers such as drums or boxes, or wrapped in burlap or other protective covering before sealing in bags or poly sheeting.
5. Label containers for friable ACM waste:
   a. OSHA warning label.
   b. DOT performance-oriented hazardous material label.
   c. Name and address of generator and abatement location.
6. Removing items from the Work Area:
   a. Packaged asbestos wastes shall be HEPA-vacuumed before removing from the Work Area.
7. Storage of packaged asbestos wastes shall be in a completely enclosed dumpster, or other suitable container that can be secured. The secured area shall be kept locked at all times to prevent unauthorized access.
8. Shipment of items from the project:
   a. Decontaminated tools and equipment may be shipped by normal carrier to warehouse, another jobsite, or other destination.
   b. For asbestos wastes:
      1) Line shipping container with 6 mil poly prior to loading packaged friable asbestos wastes.
      2) Post NESHAP placards during loading of friable asbestos wastes.
      3) Execute the NESHAP-required Waste Shipment Record (WSR) to be signed by the generator, transporter, and landfill. All WSRs shall be returned to the MEC within 30 days of shipment.
      4) Only landfills approved and permitted for accepting asbestos wastes may be used for disposal.

END OF SECTION

SECTION 02 82 14
ASBESTOS ABATEMENT - INTERIORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. These environmental requirements apply to all PBCC projects. These specifications apply for all demolition, construction and renovation projects that require the removal and disposal of asbestos containing material from the inside of a building in accordance with all applicable regulations.

B. Asbestos abatement in interior building spaces, covered walkways or porticos connecting buildings, and on outdoor mechanical systems which condition indoor air (such as air handling units, air conditioners, cooling towers, etc.) is governed by rules established by the Illinois Department of Public Health (IDPH). These specifications address or reference the requirements for complying with IDPH, OSHA, and EPA NESHAP asbestos rules. Each and every rule requirement may not be restated in detail since trained, accredited, and licensed Contractors and individuals are required for this work and are presumed to be familiar with the relevant laws and rules. Full regulatory compliance is required, and is a part of the contract, whether specifically stated herein or not.

C. Exterior building spaces are not subject to IDPH rules unless the abatement procedures involve interior spaces of the building. Roofing, exterior transite sheeting, asbestos siding, asbestos-containing paint, caulking, glazing, flashings, cements, or other products installed on the building exterior are subject to OSHA and NESHAP rules which, in many cases are less rigorous than IDPH requirements. Abatement of these items is specified in separate, related specification sections.

1.02 DEFINITIONS

A. In addition to the terms listed below, all definitions in the laws and regulations specified elsewhere in the specifications are incorporated by reference, whether or not restated herein.

B. Abatement Contractor (AC): the entity responsible for performing the work in the specifications and has the training and accreditation to competently perform the work. This entity shall obtain and maintain licenses required for the indoor work in the specifications.

C. Architect on Record (AOR): any person or firm employed by the PBCC for the purpose of designing the project.

D. Asbestos Abatement Supervisor (Supervisor): any person who supervises asbestos abatement workers. This person must be trained, accredited, and meet OSHA competent person criteria for asbestos abatement.

E. CDPH: Chicago Department of Public Health.

F. Competent person: one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f): in addition, for roofing materials (considered Class II work) who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent.

G. Contractor: the entity responsible for performing the complete scope of work in the Documents. The Contractor may elect to self-perform or subcontract out any portion of the work.

H. Managing Environmental Consultant (MEC): the entity with overall responsibility for the environmental aspects of the project, including design, organization, direction, and control as well as investigations, assessments and on-site supervision of project managers.

I. Environmental Project Manager (EPM): the project manager selected by the MEC to perform environmental monitoring and act on behalf of the MEC for the PBCC on the project.

J. HEPA Filter: a High Efficiency Particulate Air filter capable of trapping 99.97% percent of particles greater than 0.3 micrometers in mass median aerodynamic equivalent diameter.

K. IDPH: the Illinois Department of Public Health.

L. PBCC: Public Building Commission of Chicago, the Owner of the property and the authority ordering the work specified herein.

M. PBCC Representative: the entity responsible for overall project coordination and completion.

N. OSHA: the federal Occupational Health and Safety Administration.

O. Plasticize: to apply plastic sheeting over surfaces or objects to protect them from contamination or water damage.

P. Personal Protection Equipment (PPE): the protective suits, head and foot covers, gloves, respirators and other items used to protect persons from asbestos or other hazards.

Q. RCRA: the Resource Conservation and Recovery Act and associated regulations.

R. SDS: Safety Data Sheets, required by OSHA for any chemical in the workplace that that could be expected to cause an exposure to workers during normal use or in emergency situations.

S. TCLP: the Toxicity Characteristic Leaching Procedure as specified in EPA 530/SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods 3rd edition, November 1986.

T. Work: the obligations of the Contractor under the Contract Documents. Work includes, unless specifically excepted by the Contract Documents, the furnishing of all materials, labor, equipment, supplies, plant, tools, scaffolding, transportation, superintendence, permits, inspections, occupancy approvals, insurance, taxes, and all other services, facilities and expenses necessary for the full performance and completion of the requirements of the Contract Documents. Work also means that which is furnished, produced, constructed, or built pursuant to the Contract Documents.

U. Work Area: the area or areas where asbestos abatement is being conducted.

V. Work Site: the room or rooms undergoing lead abatement activities. All closets/book rooms/coat hanger rooms/vestibules/washrooms within a room are considered part of the Work Site in which abatement work has been identified on the Drawings, whether or not they are numbered separately.

1.03 SCOPE OF WORK

A. Refer to Contract Drawings and Environmental Scope Sheets in Section 02 24 01.

B. The Work includes all labor, equipment, materials, and supplies necessary to perform the Scope of Work in the bid documents by the procedures described herein. The Contractor, by submitting a bid for the Work, represents itself as knowledgeable and expert in the performance of the Work, and includes all things usually and customarily necessary to provide a complete and finished job, whether specifically mentioned or not.

C. Removal of friable and non-friable asbestos-containing materials listed in the bid documents, including pre-cleaning, moving of furnishings, establishing regulated areas, isolating the Work Areas, protection of adjacent areas, containment when required, cleanup and decontamination to the specified clearance levels, proper packaging and disposal of wastes, and all other steps necessary to complete the scope of work.

D. Repair or replacement of damaged surfaces, fixtures, or furnishings to restore them to their pre-existing condition to the satisfaction of the Architect of Record and the PBCC Representative.

E. When the bid documents include lead and asbestos abatement items in the same spaces, they should be performed in the sequence and combinations that produce the most efficient results, minimize concentrated lead waste volume, and produce the least amount of total waste. That sequence will generally be:
   1. Cleanup of lead dust, flakes, chips, and residues most likely to fail a TCLP test. If both lead and asbestos debris are present and mixed together, they may be cleaned up and disposed together.
   2. Cleanup and removal of failed or delaminated friable asbestos-containing debris, if any.
   3. Removal of friable asbestos materials and cleanup of visible residues.
   4. Removal of lead-bearing architectural components.
   5. Removal of non-friable asbestos items. If both asbestos and lead are on the same components, for example lead paint and asbestos-containing glazing compound, the components may be removed and disposed with both the lead and asbestos-bearing items intact.
   6. Removal of lead-based paint, coatings, or surfacing material.
   7. Final cleanup and decontamination of the work space. Final air clearance (asbestos) and wipe samples (lead) may be performed concurrently.
   8. When lead and asbestos final decontamination processes are combined, the more stringent cleanup procedures shall apply for both.
   9. Waste disposal:
      a. Hazardous waste: loose paint flakes, chips, and dust; lead-specific cleaning supplies; contaminated soil; combined final decontamination supplies; disposable suits, gloves, head covers, and foot covers; other items that fail a TCLP or other RCRA test.
      b. Special waste: friable asbestos-containing waste materials and lead-contaminated waste that has passed TCLP or other RCRA tests.
      c. Construction and Demolition (C&D) debris: lead-bearing architectural components; concrete and lumber with or without tile or mastic attached; demolition debris, and other general wastes.
      d. All asbestos-containing or lead-bearing wastes, regardless of classification, shall be disposed in a landfill approved by the IEPA to accept asbestos-containing or lead-bearing waste materials.

F. Compliance with all applicable laws, regulations, standards, and these specifications. In the case of a conflict, the Contractor shall comply with the most stringent.

G. Contractor is required to fully comply with IDPH rules and these specifications unless a variance is granted by IDPH. Any variances obtained by the MEC will be listed in the bid documents.

H. All licenses, accreditations, permits, fees, notifications, reports, or other documents required by law, regulation, this specification, or the bid documents.

I. Provide project closeout documentation to the APM within thirty (30) days after final clearance. This documentation shall include, but is not limited to, submittals specified elsewhere in the specifications.

1.04 LAWS, REGULATIONS AND STANDARDS

A. The following laws, regulations, and standards are incorporated by reference:
1. 105 ILCS 105: Illinois Asbestos Abatement Act
2. 77 Ill. Adm. Code 855: Asbestos Abatement for Public and Private Schools and Commercial and Private Buildings in Illinois
3. 29 CFR 1910: US OSHA General Industry Standards
4. 29 CFR 1926: US OSHA Construction Standards
5. 29 CFR 1926.1101: US OSHA Asbestos Construction Standards
6. ASHARA: US EPA Asbestos School Hazard Abatement Reauthorization Act
7. 40 CFR Part 61: US EPA National Emissions Standards for Hazardous Air Pollutants (NESHAP), 11/90 revision
8. 40 CFR 763 Subpart E: US EPA Asbestos Hazard Emergency Response Act (AHERA) Rules
9. 40 CFR 763 Subpart E: US EPA Asbestos Model Accreditation Plan (MAP): Appendix C-Interim Final Rule
10. 11-4-2170 Chicago Building Code - Demolition and Renovation Safeguards
11. 11-4-2150 Environmental Standards related to demolition, renovation, asbestos abatement and maintenance, sandblasting, chemical washing, and grinding of buildings or other structures

1.05 ASSESSMENT, MONITORING, TESTING AND ANALYSIS

A. The MEC will perform inspection, testing and design services prior to the start of Work, and during the project, and will perform testing, inspection, and monitoring services during the Work and upon its completion:
1. Prior to the start of the Work, the MEC shall:
    a. Identify suspect materials and confirm their asbestos content through review of the school's management plan or by testing.
    b. Design the project and address any design changes if requested by the AOR/PBCC's Authorized Representative.
    c. Collect background air samples before conditions are disturbed. Background samples will be analyzed by Phase Contrast Microscopy (PCM).
    d. Review and approve the pre-abatement submittals submitted by the AC.
2. During the Work, the MEC shall:
    a. Enter the Work Area at least every two hours to inspect the Work procedures and Work Area integrity.
    b. Maintain a daily log to record the day's events, problems, corrective actions.
    c. Collect air samples inside and outside the Work Area, and in the breathing zone of representative persons.
    d. The MEC will stop the Work if airborne asbestos concentrations outside the Work Area exceed 0.01 f/cc or the background sample levels, whichever is higher. The Work may restart when the source of fiber release has been identified and corrected. Contractor shall be responsible for cleaning and decontaminating the outside area if caused by the asbestos abatement activities.
    e. Observe/document smoke testing of the containment by the Contractor.
    f. Review original worker licenses and maintain weekly submittals from the AC.
    g. Notify the MEC's project designer if design changes are needed before execution.
3. Upon completion of the Work, the MEC shall:
    a. Inspect for visible debris. Contractor shall be required to re-clean the area or portions of areas until no visible debris remains and the Work Area is dry.

b. Perform aggressive clearance testing by Transmission Electron Microscopy (TEM) when the ACM in a Work Area is 260 linear feet, 160 square feet, or 35 cubic feet of volume or more, as required by AHERA and IDPH Section 855.170. The sample set shall include at least 5 inside samples, 5 outside samples, 2 field blanks and 1 sealed blank. Note: Large complicated, or multi-floor contiguous Work Areas connected by corridors, stairways, or other connections shall be tested using additional inside the Work Area samples. For clearance of multiple mini containments containing a total removal quantity greater then160 square feet or 260 linear feet, a combined PCM/TEM final clearance procedure may be used. The first part of the procedure shall involve the collection and analysis of one PCM sample from within each mini containment. The second part shall involve the collection and analysis of five (5) TEM samples within the mini containments having the highest PCM analysis results. If there are five or fewer mini containments to be sampled, then only TEM sampling shall be conducted. A minimum of five (5) TEM samples shall be collected. All requirements of 40 CFR 763 Subpart E, Appendix A shall apply.

c. Perform aggressive clearance testing by PCM when the ACM in a Work Area is less than 260 linear feet, 160 square feet, or 35 cubic feet of volume.

d. Collect and analyze samples in accordance with AHERA Appendix A procedures and IDPH rule section 855.470.

e. Prepare and submit the IDPH “Project Manager’s Summary Report Form” within 10 days of final clearance.

f. Prepare and submit the Project Manager Report to the IDPH within 60 Working days of clearance testing. The final Project Manager is responsible for completion of the project report.

B. The Contractor shall provide OSHA compliance air monitoring to determine exposures to its employees in accordance with OSHA 29 CFR 1926.1101. Frequency of testing shall comply with OSHA requirements for the anticipated and actual exposure levels.

1. A written Exposure Assessment may be provided prior to the start of the Work to determine the requirements for respiratory protection and frequency of OSHA monitoring for each type of activity. The Contractor should note that a Negative Exposure Assessment (NEA) may be possible for many tasks. For interior work, this would allow reduced OSHA monitoring frequency.
2. Analysis may be performed on site.

C. Credentials required for testing and analysis of PCM final clearance air samples:

1. Accreditation by AIHA or AAR; or
2. Participation in the Proficiency Analytical Testing (PAT) program.
3. Certification of individual qualification to read samples on site when on site analysis is performed.

1.06 SUBMITTALS

A. To CDPH at least 10 working days before commencement of Work:

1. State of Illinois Demolition/Renovation/Asbestos Project Notification form.
2. Written permission from building Owner authorizing Contractor to commence work

B. To IDPH, IEPA, CDPH, MEC and AOR at least 10 working days before commencement of Work (if required per quantity of materials being abated):

1. IDPH Asbestos Notification on current form, including inspector license number and landfill permit number.
2. Written permission from building Owner authorizing Contractor to commence abatement.
3. Building Owner asbestos abatement notification to building users and the PBCC.
4. School Floor Tile Project Notice, when applicable.

C. To MEC and AOR at least five days prior to commencement of Work:
   1. Documentation of arrangements of transport and disposal, landfill name and location, handling procedures and PPE at the landfill, prepared and signed by the landfill.
   2. Drawings or sketches for layout and construction of isolation barriers and decontamination units.
   3. Respirators: NIOSH approvals and manufacturer certification of HEPA filtration for cartridges.
   4. Manufacturers' certifications that all HEPA vacuums, negative air pressure equipment, and other local exhaust ventilation equipment conform to ANSI Z9.2-79.
   5. Written notifications to rental companies for any rental equipment used.
   6. Results of any performance tests for encapsulants, if applicable.
   7. OSHA Exposure Assessment, if available.
   8. Laboratory and analyst credentials for Contractor OSHA samples.
   9. Safety Data Sheets (SDS) for chemicals used on site.
   10. Work Plan and Schedule.

D. To MEC and AOR on the first day of abatement Work:
   1. Original Contractor, supervisor, and worker licenses along with a copy each.
   2. Initial Course Accreditation and current refresher accreditation for each supervisor and worker.
   3. Physician's Written Opinions for workers and supervisors.
   4. Fit test documentation for all employees, agents.

E. To MEC and AOR weekly during the abatement Work:
   1. Job progress reports detailing abatement activities, progress compared to schedule, problems and actions taken, injury reports, and equipment breakdowns.
   2. Waste Shipment Records.
   3. Work Site Entry logs.
   4. Manometer readable tape for negative pressure differentials for each negative pressure worker enclosure or a log of digital readout.
   5. Filter Change logs for respirators, HEPA vacuums, negative air machines, and other engineering controls.
   6. OSHA compliance air monitoring data.
   7. Worker license and certification log.

F. Prior to beginning Work, the AC shall submit required notifications to applicable regulatory agencies and receive an Owners Authorization and Notice to Occupants from the Board for buildings where asbestos abatement will take place. The AC shall provide copies of all regulatory notices to the PBCC Representative, MEC, and the EPM within 24 hours of sending such notices to the regulatory authority. The AC shall not begin a project until such notices are provided to all parties listed above.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. All tools and equipment shall at least conform to minimum industry standards and IDPH regulations.

B. Equipment:
   1. Negative Air Machines shall provide HEPA filtration and conform to ANSI Z9.2 fabrication criteria.
   2. Respirators shall be NIOSH approved for use with lead, asbestos, or other contaminants anticipated in the Work.

3. Contractor is fully responsible for complying with OSHA rules for other Safety equipment, such as hard hats, safety harnesses, eye protection, gloves, footwear, and any other safety devices used on the site.
4. Pressure differential manometer with readable tape shall be provided by the Contractor, including calibration documentation.

C. Tools:
1. Shovels and scoops shall be rubber or plastic, suitable for use in a plasticized containment. Metal shovels are not permitted.
2. Scrapers, brushes, utility knives and other hand tools shall be of good quality and suitable for the intended uses. The Contractor shall keep an ample supply on hand for the completion of the Work
3. Power tools such as, but not limited to saws, pneumatic chisels, brushes, sanders, and needle guns shall be equipped with shrouds and HEPA-filtered local exhaust systems to capture released particles.
4. Buffers are not permitted.

2.02 MATERIALS

A. All materials shall at least conform to minimum industry standards and IDPH regulations.

B. Installed materials which become a part of the Work such as, but not limited to, encapsulants shall be of good quality, non-lead-bearing, free of asbestos, and conform to the respective reinstallation specification sections prepared by others.
1. Contractor shall ensure that encapsulants and sealants used as primers, basecoats, or covering existing materials are compatible with the respective existing or reinstallation materials and their manufacturers' warranties.
2. Encapsulants for surfaces to which fireproofing shall be applied (beams, columns, floor or roof decks, other structural members) shall be tested and rated as a component of the fireproofing system and listed in the UL Fire Resistance Directory with the specific fireproofing material to be installed.

C. Abatement Materials:
1. Fire-retardant Poly sheeting for all applications shall be 6 mil nominal thickness for critical seals, floors, ceilings and drop cloths, and 4 mil for walls.
2. Tape shall be 2" or 3" duct tape or other waterproof tape suitable for joining poly seams and attaching poly sheeting to surfaces.
3. Spray adhesives shall be non-flammable and free of methylene chloride solvents.
4. Disposal bags shall be 6 mil.
5. Disposable suits, hoods, and foot coverings shall be TYVEK or similar.
6. Solvents shall be compatible with any primers, mastics, adhesives, paints, coatings, or other surfacing materials to be installed following their use.

PART 3 - EXECUTION

3.01 EMPLOYEE TRAINING, QUALIFICATION AND MEDICAL SCREENING

A. Supervisors and Workers shall be trained, accredited, and licensed in accordance with IDPH rules.
1. Contractor shall keep copies of licenses and most recent annual refresher training certificate at the jobsite at all times for all Contractor personnel.
2. An IDPH- licensed supervisor (competent person) shall be present at the Work Site at all times when Work under these specifications is being conducted.
3. Current fit testing documentation.

B. Medical Screening. All Contractor personnel shall have a current medical examination in accordance with OSHA requirements. Copies of the Physician's Written Opinions shall be kept on site.

3.02 PERMISSIBLE EXPOSURE LIMITS

A. The OSHA Permissible Exposure Limit (PEL) for worker exposure to airborne asbestos is 0.1 f/cc as an 8-hour time-weighted average (TWA).

B. The OSHA short term excursion limit for worker exposure to airborne asbestos is 1.0 f/cc for a 30 minute sample.

C. The permissible level of airborne fibers in areas adjacent to the Work Area is 0.01 f/cc or background level, whichever is higher, as determined by PCM.
   1. Work shall immediately cease in any Work Area where the airborne fiber concentrations exceed this level.
   2. The source of outside contamination shall be determined, and corrective measures (e.g. wet cleaning, changes in work practices, negative pressure containment) shall be implemented to prevent recurrence.
   3. The Contractor shall be responsible for cleanup of contamination in adjacent areas caused by the asbestos abatement activities at no additional cost to the building Owner.

3.03 EXPOSURE ASSESSMENT AND MONITORING

A. The Contractor shall make an assessment of the airborne exposures. Assessment shall conform to OSHA requirements and may be based upon:
   1. Initial monitoring of representative workers who the Contractor believes are exposed to the greatest airborne concentrations of asbestos, or
   2. Past monitoring (within the past 12 months) or objective data for conditions closely resembling the processes, type of material, control methods, work practices and environmental conditions to be used for this project, or
   3. In the absence of an exposure assessment, the Contractor shall perform the Work in full negative pressure containment with Type C pressure-demand respirator with auxiliary SCBA escape bottle.

B. The Contractor shall perform personal monitoring in accordance with the following requirements:
   1. Initially, to establish an exposure assessment when past monitoring or objective data are not available for an initial determination.
   2. Periodically if the exposures are, or are expected to be, below the PEL.
      a. Whenever there has been a change of equipment, process, control, personnel, or a new task has been initiated that may affect employee exposures, the exposure assessment shall be updated, and monitoring shall be reinstituted if exposures are unknown or are expected to exceed the PEL.
   3. Daily, if exposures are above the PEL.

3.04 RESPIRATORY PROTECTION

A. Respiratory protection shall be worn by all persons potentially exposed to airborne asbestos fibers from the start of the abatement project until all areas have passed clearance air monitoring, in accordance with all applicable laws, regulations and standards specified elsewhere in the specifications.

B. Contractors must have a respiratory protection program in compliance with all applicable laws, regulations and standards specified elsewhere in the specifications.

3.05 HYGIENE PRACTICES

A. Eating, drinking, smoking, chewing gum or tobacco, and applying of cosmetics are not allowed in the Work Area.

B. All persons entering the Work Area are required to wear appropriate PPE, and follow the entry and exit procedures posted in the Personnel Decontamination Enclosure System.

C. Personal Protection Equipment (PPE) shall include:
1. Full body disposable suits, headgear, and footwear.
2. Gloves.
3. Safety glasses
4. Hardhats.
5. Non-disposable footwear and clothing shall remain in the Work Area and shall be disposed of as contaminated waste when the job is completed.
6. Authorized visitors shall be provided with suitable PPE.

3.06 PROHIBITED ACTIVITIES

A. Dry removal or dry sweeping.

B. Use of compressed air for cleaning.

C. Use of high speed power tools not equipped with a HEPA-filtered local exhaust system.

D. The abatement Contractor shall not execute abatement activities without asbestos abatement design drawings that have been signed by an IDPH licensed Asbestos Designer are on the job site. Any and all changes to containment layout and placement shall not be executed until revised design drawings that have been approved and signed by an IDPH licensed Asbestos Designer are on the job site.

E. Buffers cannot be used to remove mastic.

3.07 WORK AREA ISOLATION AND PREPARATION

A. General Preparation:
1. Post:
   a. Caution signs meeting the specifications of OSHA 29 CFR 1926.1101 (k)(6) at any location and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels.
   b. Decontamination and Work procedures in equipment rooms and clean rooms.
   c. EPA NESHAP asbestos rules (40 CFR Part 61, subparts A & M) in the clean room.
   d. OSHA Asbestos Construction Standards (29 CFR 1926.1101) in the clean room.
   e. Entry and Exit Log.
   f. List of telephone numbers in the clean room for:
      1) Local hospital and/or local emergency squad.
      2) School security office (if applicable).
      3) Owner representative reachable 24 hours per day.
      4) Contractor’s headquarters.
      5) Architects or consultants directly involved in the project.
2. Secure the Work Area from entry by unauthorized persons.
3. Separate Work Areas from Occupied Areas.
   a. Seal off all doorways and corridors which will not be used for passage during Work.

b. Install IDPH required separation barriers per section 855.430 (a) in all openings larger than 4 ft by 8 ft, consisting of wood or metal framing, a sheathing material such as plywood or drywall at least 5/8" thick on the work side, and double-layer 6-mil poly, both sides. Edges shall be caulked at the floor, ceiling, walls, and fixtures to form an air-tight seal.
c. If the school is not totally occupied (see Section 855.430), the sheathing material may be omitted.

4. Separate Occupied areas from Secured Areas.
   a. Install IDPH barriers per section 855.430 (b).

B. Interior Preparation:
1. Shut down and lock out electric power to all Work Areas. Provide temporary power from an outside source with ground-fault circuit interrupter (GFCI) at the source.
2. Shut down and isolate heating, cooling, and ventilating air systems. Remove HVAC filters, package and dispose as asbestos waste.
3. Pre-clean movable objects with HEPA vacuums or wet cleaning and remove from the Work Area to a location designated by the MEC where friable ACBM is involved.
4. Pre-clean fixed items which must remain in the Work Area with HEPA vacuums or wet cleaning where friable ACBM is involved.
5. Wrap all fixed objects and equipment which will remain in the Work Area with a minimum of one layer of six mil poly.
6. Remove/protect carpeting per environmental scope sheets.
7. Pre-clean the Work Area with HEPA vacuums or wet cleaning.
8. Seal off all windows, corridors, doorways, skylights, ducts, grilles, diffusers, and other penetrations or openings in walls, ceilings and floors with 6-mil poly and tape.
9. Cover floors with two layers of fire-retardant 6-mil poly with seams staggered and taped, and extending 12" up walls. Cover walls with two layers of 4-mil poly, with each wall poly overlapping each floor poly layers by 12".
10. Asbestos materials shall not be disturbed during the preparation phase.
11. Suspended ceilings shall remain in place until preparation phase is complete. Remove/protect ceiling tile per environmental scope sheets.
12. Maintain emergency and fire exits.
13. Install a five chamber Worker Decontamination Enclosure System, consisting of clean room, shower room, and dirty room separated by airlocks at least 3' wide, all with curtained doorways, of sufficient size to serve the size of the crew, and with all features required by IDPH rules.
    a. Where a remote decon unit is used (i.e. non-friable ACBM and TSI glove-bag operations), the AC shall:
       1) Set up the decon unit within the Work Area barriers.
       2) Establish a negative pressure of at least 0.02" water column (wc) between the dirty room and adjacent spaces, including the clean room.
       3) Provide at least 4 air changes per hour within the decon unit.
       4) Use a double suiting procedure where the workers proceed to the Work Area exit, HEPA-vacuum gross debris from their persons using a "buddy system" put on a clean suit (either over their dirty suit or after removing the dirty suit), assure that their footwear are free of ACM contamination, and follow a designated path to the remote decon unit.
       5) Once in the decon unit, follow normal decontamination procedures.
14. Install an Equipment Decontamination Enclosure System, consisting of a washing station and a holding area, with curtained doorways and a lockable door.
15. Maintain a negative pressure of at least 0.02" water column (wc) between each contained area and adjacent spaces 24 hours a day using negative air machines vented to the outside, from the start of abatement work to final clearance. Backup negative air machines shall be available onsite in case of machine failure.
16. Once operational, the system shall be inspected daily with smoke tubes by the Contractor. Damages and defects shall be repaired immediately upon discovery.

C. Exterior Preparation (for areas that interface with interior work):
1. 6 mil plastic sheeting shall be placed over the ground, foundation, or other surfaces below the abatement area.
2. Unauthorized entry shall be prevented by using appropriate barriers, such as warning tape, fencing, or other suitable barriers.
3. Nearby air intakes, grilles, and other openings into the building interior shall be sealed off with poly and tape.
4. The Contractor shall be responsible for cleanup of any adjacent areas that become contaminated as a result of the abatement activities at no additional cost to the building Owner.

3.08 ABATEMENT PROCEDURES

A. Removal:
1. Asbestos materials shall be adequately wetted and kept adequately wet during removal.
2. ACM waste shall be bagged or containerized as it is removed.
3. Work Areas shall be kept wet until visible material is cleaned up.

B. Encapsulation:
1. Damaged or missing areas of existing materials shall be repaired with non-asbestos substitutes, where appropriate.
2. Loose or hanging ACM shall be removed using appropriate removal procedures.
3. Bridging encapsulants shall be applied in accordance with manufacturer’s instructions.
4. Penetrating encapsulants shall be applied to penetrate existing materials to the substrate.
5. Encapsulants shall be applied with airless spray equipment.
6. Encapsulated ACM shall be labeled as asbestos to prevent future unprotected disturbance.

C. Enclosure:
1. Locations where openings for hangers, supports, framing, or other attachments must be made in the ACM must be misted with water and kept damp to reduce airborne fiber release. Tools used to drill, cut, or otherwise disturb the ACM during attachment installation shall be equipped with a HEPA-filtered local exhaust system.
2. Loose or hanging ACM shall be removed using removal procedures.
3. Damaged areas shall be repaired with non-asbestos materials.
4. Utilities or other items requiring access shall be relocated outside of the enclosure area. Once enclosures are installed, they shall not be opened or disturbed.
5. Enclosure materials shall be impact resistant and provide an airtight barrier.
6. Enclosures shall be labeled that they contain asbestos materials to prevent future unprotected disturbance.

3.09 CLEANING AND DECONTAMINATION

A. Cleaning and decontamination of abatement areas, excluding glove-bag areas, are as follows:

B. All visible accumulations of ACM, debris, tools, and unnecessary equipment shall be removed from the Work Area.

C. First clean:
1. Wet clean all surfaces and remove excess water.
2. Wait 12 hours before proceeding further to allow dust and fibers to settle.
3. Remove outer layer of poly and dispose as ACM waste.
4. Completion of First Clean shall be determined and documented by the MEC.

D. Second clean:

1. Wet clean all surfaces and remove excess water.
2. Wait 12 hours before proceeding further to allow dust and fibers to settle.
3. Remove inner layer of poly and dispose as ACM waste.
4. Critical barriers on windows, doors, penetrations, and other openings shall remain in place and negative air system shall remain in continuous operation until final clearance tests have passed.
5. Completion of Second Clean shall be determined and documented by the MEC.

E. Third clean:
1. Wet clean all surfaces and remove excess water.
2. Wait 12 hours before proceeding further to allow dust and fibers to settle.
3. Remove all tools, cleaning materials, remaining wastes from the Work Area. Tools and equipment shall be cleaned before removal.
4. Third Clean shall be determined and documented by the MEC.

F. Visual inspection: MEC and Contractor shall jointly inspect the Work Area for visible residue and excess water and, if observed, repeat the clean/12 hour wait cycle until residues are not detected and Work Area is dry.

G. Apply lock-down encapsulants where specified in the bid documents.

H. MEC will inform AC if the Work Area is ready for final clearance testing.

3.10 FINAL CLEARANCE

A. Final clearance testing (aggressive methods) shall be performed after 12 hours have lapsed since the final cleaning, and when visual inspection has been completed and no visible water or condensation remains.

B. Work Areas with 260 linear feet or 160 square feet or more of ACM shall be tested using aggressive sample collection methods and TEM analysis, as required by AHERA and IDPH Section 855.170. The sample set must include at least 5 inside samples, 5 outside samples, 2 field blanks, and 1 sealed blank. NOTE: Large, complicated, or multi-floor contiguous Work Areas connected by corridors, stairways, or other connections may be tested with a larger “inside” sample set rather than full, multiple TEM tests, so long as the inside sample distribution is reasonably representative of the Work Area conditions.

C. Work Areas with less than 260 linear feet or 160 square feet may be tested using aggressive sample collection methods and analyzed by PCM.

D. If final clearance test(s) fail, the AC is responsible for repeating the cleaning sequence as necessary until final clearance tests are successful. All expenses associated with the collection and analysis of additional final clearance tests are the responsibility of the AC.

3.11 SPECIAL PROCEDURES:

A. Less stringent requirements may apply in a number of cases.

B. Variances from IDPH Regulations. Variances may be requested and approved by the IDPH. These less stringent procedures may only be used when they have been requested by the Project Designer and approved by the IDPH on a case-by-case basis.
1. Variances that have been applied for the project will be listed in the bid documents. These variances may or may not be approved by the IDPH.
2. The Contractor is encouraged to request additional variances it believes will be beneficial to the project. Such requests shall be submitted to the Project Designer/MEC as a value

engineering proposal which references the IDPH regulation section, describes the procedure variations, includes information which supports the efficacy and benefits of the alternative procedures, and offers appropriate cost savings.

3. Otherwise the Contractor is required to fully adhere to the requirements of this specification. Failure to obtain a variance shall not constitute a change in the requirements of these documents.

C. Operations and Maintenance Procedures where minor areas of ACM must be disturbed for building repairs or require repair in areas of Work, such as drilling holes in walls or floors, cleaning small areas to allow installation of fixtures, smoke detectors, utilities, etc. The bid documents shall state if these procedures are allowed or required for a particular project or task.

1. Submit an asbestos notification to the IDPH for quantities over 3 linear or square feet.
2. Licensed abatement workers are required, but a licensed abatement Contractor is not mandatory for Work less than 3 linear or square feet.
3. Shut down heating, cooling, or ventilating air systems to prevent fiber dispersal to other areas.
4. Seal off openings in the Work Area, including windows, doorways, vents, and other openings with 6 mil poly sheeting and tape.
5. Lay an impermeable drop cloth under the Work Area.
6. Wear appropriate PPE and at least a 1/2 mask APR respirator. Note that OSHA still requires an exposure assessment and respirators that are appropriate for the expected airborne fiber concentrations.
7. Use wet removal methods.
8. Wet clean Work Area, leaving no visible residue.
9. Seal off any frayed ends of material remaining on an active utility or building structure to remain.
10. Package and dispose of asbestos-containing waste as specified in the waste disposal Article of the specifications.

D. Glovebag Procedure. Glove-bags may be used to remove pipe and duct insulation.

1. Normal IDPH Notification requirements apply to quantities of more than 3 linear or square feet.
2. Glove-bag removal shall require a single layer, 6 mil poly tent containment (mini-containment) with negative pressure air filtration.
3. Monitoring will be performed for each contained area by the MEC:
   a. 1 personal sample
   b. 1 area sample
   c. 1 area sample at each negative pressure machine exhaust
4. Glove-bag construction shall be 6 mil poly with seamless bottom, suitable for the intended use (straight runs, fittings, elbows, vertical pipes, etc.) without modification.
5. At least two licensed workers shall perform glove-bag operations.
6. Workers shall wear full body PPE and at least a 1/2 mask APR respirator. Note here, too, that OSHA still requires an exposure assessment and respirators that are appropriate for the expected airborne fiber concentrations.
7. Prior to use, all loose or damaged material adjacent to the operation shall be wrapped in two layers of 6 mil poly or otherwise be rendered intact.
8. Work Practices shall include:
   a. Installation to completely cover the circumference of pipe or other structure. Pipe insulation diameter shall not exceed 1/2 the bag working length above the glove sleeves.
   b. Smoke test for leaks and seal any leaks prior to use.
   c. Glove bag shall be single use and not moved once it is placed.
   d. Wet removal methods on the materials to be removed and wet cleaning to remove all visible ACM from the pipe or structure surfaces.
   e. Not to be used on surfaces having temperatures greater than 1500F.
   f. Spray down the interior surfaces of the bag, substrate, and removed ACM.

g. First and second cleaning, waiting at least 12 hours following each cleaning.
h. Wet down remaining ACM surfaces or seal with encapsulant.
i. Seal off the lower portion of the bag containing the ACM waste by twisting several times and sealing with tape.
j. Collapse glove-bag with a HEPA vacuum.
k. Slip a 6 mil poly waste disposal bag over the glove-bag, detach the bag from the pipe, and gooseneck-seal it in the waste disposal bag.
l. Dispose in accordance with this specification.

E. Resilient Floor Covering. Removal of resilient floor covering shall be performed by, as a minimum, those trained in accordance with OSHA Class 2 requirements, using heat guns, infrared heat machines or other methods that remove the floor covering in whole pieces. Buffing machines may not be used for removal of mastic. The Contractor shall insure that no damage is caused to the area or equipment below the floor. Abatement procedures are as follows:
1. Submit the Floor Tile Project Notice at least 10 working days prior to the beginning of all asbestos resilient floor covering abatement projects.
2. Post signs so that the Work Area cannot be entered from any direction without observing a sign.
3. Isolate the Work Area from areas to remain occupied.
4. Install barriers of six mil plastic sheeting sealed with duct tape at all openings in the Work Area.
5. Install a curtained doorway at the entry to the Work Area, lock out electrical power to the room and supply required power with ground fault interruption protected circuits.
6. Wear, as a minimum, half-faced dual cartridge NIOSH-approved respirators and double disposable suits.
7. Remove floor covering without causing excessive breakage. Work shall stop and appropriate IDPH design, project management and air sampling will be put in place if excessive breakage occurs.
8. Dispose of floor covering and debris as asbestos waste.
9. HEPA vacuum the Work Area thoroughly following completion of the removal.
10. HEPA vacuum surface of protective clothing and dispose of clothing as asbestos waste.
11. Personal air monitoring shall be performed by the Contractor in accordance with OSHA.

F. Electrical Wiring Insulation: Removal of the electrical wiring insulation shall be performed by licensed asbestos abatement Contractor under full-containment. This Work is considered gross removal Work. All Work shall be performed in compliance with laws, regulations, and standards specified elsewhere in the specifications. If IDPH approves any variances for this project, they will be provided to the abatement Contractor prior to the start of the project. The abatement shall be performed as follows:
1. Contractor shall provide submittals as specified elsewhere in the specifications.
2. The Contractor Supervisor shall inform all abatement workers about electrical safety and require them to work in accordance with all applicable safety requirements while working on and around electrical system components.
3. Work Area shall be isolated and prepared as per procedures specified in of these specifications.
4. Contractor shall verify that electrical power to wiring within the Work Area is locked out /tagged out for the duration of the project until final air clearance is achieved. Contractor shall verify that a competent person has de-energized, locked out, tagged out and tested the electrical lines involved in this project to ensure lock out/tag out was successful. Water shall not be sprayed around wiring and/or other electrical system components. Moist rag or mops shall be used as needed. Contractor shall keep Work Area free of any standing water throughout this project.
5. Disconnect wire at both ends without cutting wire or otherwise disturbing wire insulation. Remove wires intact, by pulling them from one access point (preferably at the panel or switch) and rolling them up directly into an asbestos waste bag (or a glove-bag, where feasible).

6. HEPA vacuum shall be used continuously while wires are being pulled out, in order to minimize the airborne dispersal of asbestos fibers. Wet rags shall be utilized to moist the wiring insulation as the wire is being pulled out and rolled-up in order to minimize the release of asbestos fibers.
7. The conduit and other surfaces which were in contact with wires shall be cleaned utilizing HEPA Vacuum. Moist rags/sponges shall be pulled through the conduits so as to clean the conduit surfaces after wires have been pulled out of the conduit.
8. Cleaning and Decontamination of Work Area shall be performed as specified in of these specifications. Contractor shall keep the Work Area free of any standing water throughout this project. Water shall not be sprayed around wiring and/or other electrical system components. HEPA vacuum and moist rags shall be used for cleanup and decontamination.
9. Clearance of the Work Area shall be performed as specified in of these specifications.

3.12 WASTE DISPOSAL AND EQUIPMENT LOAD-OUT

A. Preparing equipment for load-out:
1. Seal openings to prevent escape of internal contamination; or open up equipment, remove filters, and make equipment interiors accessible for cleaning and decontamination.
2. HEPA vacuum and wet wipe all equipment before removal.

B. Packaging asbestos wastes:
1. All asbestos-containing wastes, including removed ACM and debris, containment poly, critical barrier materials, suits, respirator filters, vacuum and negative air machine HEPA filters, water filters, and other asbestos-containing items shall be properly packaged for disposal.
2. Use double 6 mil plastic bags with “gooseneck” seal, or other impermeable containers.
3. Wrap large or irregular items in 2 layers of 6 mil poly sheeting, seal with tape, and affix required labeling.
4. Sharp, jagged, or other items (floor tiles, screws, nails, metal debris, wood etc.)that may puncture poly shall be packaged in rigid impermeable containers such as drums or boxes, or wrapped in burlap or other protective covering before sealing in double bags or double layers of 6 mil poly.
5. Label containers:
    a. OSHA warning label.
    b. DOT performance-oriented hazardous material label.
    c. Name and address of generator and abatement location.

C. Removing items from the Work Area:
1. Packaged asbestos wastes, non-porous debris (such as ceiling grid, doors, hardware, and other items that can be decontaminated), and equipment shall be wet cleaned, moved into the equipment decontamination enclosure system, cleaned a second time, and moved into the holding area.
2. Containers and equipment shall be removed from the holding area by workers in clean PPE and respirators who enter from the uncontaminated side (outside). The equipment decontamination enclosure system shall not be used to enter or exit the Work Area.
3. Waste shall be placed in a cart and covered. A plastic runner shall be placed on the floor to the waste storage area. The loaded cart shall be carefully taken to and unloaded into the enclosed waste storage container.

D. Storage of packaged asbestos wastes shall be in a completely enclosed dumpster or other suitable container that can be secured. The secured area shall be kept locked at all times to prevent unauthorized access.

E. Shipment of items from the project:

1. Decontaminated tools and equipment may be shipped by normal carrier to warehouse, another jobsite, or other destination.
2. For asbestos wastes:
    a. Line shipping container with 6 mil poly prior to loading packaged asbestos wastes.
    b. Post NESHAP placards during loading.
    c. Persons performing loading operations shall wear PPE and respirators.
    d. Containers and packages shall be tightly packed together to prevent shifting during transport. Large components or heavy items shall be secured to prevent shifting, and shall not be stacked on top of bags.
    e. Execute the NESHAP-required Waste Shipment Record (WSR) to be signed by the generator, transporter, and landfill. All WSRs shall be returned to the MEC within 30 days of shipment.
    f. ACBM waste shall be transported from the Work Site directly to the landfill.

F. Disposal of packaged asbestos wastes:
1. Only landfills approved and permitted by Illinois for accepting asbestos wastes may be used for disposal.

3.13 DEMOBILIZATION

A. MEC shall inspect the Work Area for evidence of visible debris prior to releasing the area for tear-down. Detection of contamination will require additional cleaning and re-testing of the Work Area.

B. Remove critical barriers and seals.

C. Restore previously-removed items, if specified in the bid documents:
1. Re-mount fixtures and other previously dismounted objects.
2. Return moveable objects to their original locations.
3. Install new filters in HVAC systems where filters were previously removed.
4. Re-establish electric systems and other utilities that were shut down or locked out.

D. A punch list walk-through shall be conducted for each cleared Work Area within two working days of clearance testing by the MEC, Contractor, and AOR. All punch list items shall be completed within five working days of walk through.

END OF SECTION

SECTION 02 82 15

ASBESTOS ABATEMENT - EXTERIORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. These environmental requirements apply to all PBCC projects. These specifications apply for all demolition, construction and renovation projects that require the removal and disposal of asbestos containing materials from the outside of buildings in accordance with all applicable regulations.

1.02 PROJECT CONDITIONS

A. Exterior building spaces are not covered by Illinois Department of Public Health (IDPH) rules, except for covered hallways or porticos connecting buildings and outdoor mechanical systems which condition indoor air (such as air handling units, air conditioners, cooling towers, etc.), or when interior building spaces are involved.

B. Roofing, window replacement, exterior transite sheeting, galbestos siding, asbestos-containing paint, caulking, glazing, flashings, cements, or other products installed on the building exterior are subject to Occupational Safety and Health Administration (OSHA) and National Emission Standards for Hazardous Air Pollutants (NESHAP) rules which, in many cases are less rigorous than IDPH requirements. All exterior asbestos abatement activities shall be conducted from the exterior of the building. At no time shall any work activity be staged from the interior of the building. Abatement of roofing materials requires supervision by a competent person that can be employed by the roofing contractor (refer to the definition of competent person below). Abatement of these items is specified in the specifications. Related paragraphs in the Interior Abatement Section may be referenced or included where relevant.

1.03 DEFINITIONS

A. In addition to the terms listed below, all definitions in the laws and regulations specified elsewhere in the specifications are incorporated by reference, whether or not restated herein.

B. Abatement Contractor (AC): the entity responsible for performing the work in the specifications and has the training and accreditation to competently perform the work. This entity shall obtain and maintain licenses required for the work in the specifications.

C. Architect of Record (AOR): any person or firm employed by the PBCC for the purpose of designing the project.

D. Asbestos Abatement Supervisor (Supervisor): any person who supervises asbestos abatement workers. This person must be trained, accredited, and meet OSHA competent person criteria for asbestos abatement.

E. CDPH: Chicago Department of Public Health.

F. Competent person: one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f): in addition, for roofing materials (considered Class II work) who is specially trained

in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent.

G. Contractor: the entity responsible for performing the complete scope of work in the bid documents. The Contractor may elect to self-perform or subcontract out any portion of the work.

H. Managing Environmental Consultant (MEC) means the entity with overall responsibility for the environmental aspects of the project, including design, organization, direction, and control as well as investigations, assessments and on-site supervision of project managers.

I. Environmental Project Manager (EPM): the project manager selected by the MEC to perform environmental monitoring and act on behalf of the MEC for the PBCC on the project.

J. Exposure Assessment: a demonstration by the employer that employee exposure during an operation is or will be consistently below the Personal Exposure Limits set by OSHA.

K. HEPA Filter: a High Efficiency Particulate Air filter capable of trapping 99.97% percent of particles greater than 0.3 micrometers in mass median aerodynamic equivalent diameter.

L. IDPH: the Illinois Department of Public Health.

M. OSHA: the federal Occupational Health and Safety Administration.

N. PBCC: Public Building Commission of Chicago, the Owner of the property and the authority ordering the work specified herein.

O. Board Representative: the entity responsible for overall project coordination and completion.

P. Plasticize: to apply plastic sheeting over surfaces or objects to protect them from contamination or water damage.

Q. Personal Protection Equipment (PPE): the protective suits, head and foot covers, gloves, respirators and other items used to protect persons from asbestos or other hazards.

R. RCRA: the Resource Conservation and Recovery Act and associated regulations.

S. SDS: Safety Data Sheets, required by OSHA for any chemical in the workplace that that could be expected to cause an exposure to workers during normal use or in emergency situations.

T. TCLP: the Toxicity Characteristic Leaching Procedure as specified in EPA 530/SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods 3rd edition, November 1986.

U. Work: the obligations of the Contractor under the Contract Documents. Work includes, unless specifically excepted by the Contract Documents, the furnishing of all materials, labor, equipment, supplies, plant, tools, scaffolding, transportation, superintendence, permits, inspections, occupancy approvals, insurance, taxes, and all other services, facilities and expenses necessary for the full performance and completion of the requirements of the Contract Documents. Work also means that which is furnished, produced, constructed, or built pursuant to the Contract Documents.

V. Work Area: the area or areas where asbestos abatement is being conducted.

W. Work Site: the room or rooms undergoing lead abatement activities. All closets/book rooms/coat hanger rooms/vestibules/washrooms within a room are considered part of the Work

Site in which abatement work has been identified on the Drawings, whether or not they are numbered separately.

1.04 SCOPE OF WORK

A. Refer to Contract Drawings and Environmental Scope Sheets in Section 02 24 01.

B. The Work includes all labor, equipment, materials, and supplies necessary to perform the Scope of Work in the bid documents by the procedures described herein. The AC, by submitting a bid for the Work, represents itself as knowledgeable and expert in the performance of the Work, and includes all things necessary to provide a complete and finished job, whether specifically mentioned or not.

C. Removal of friable and non-friable asbestos-containing materials listed in the bid documents, including isolating the Work Areas, protection of adjacent areas, cleanup, proper packaging and disposal of wastes, and all other steps necessary to complete the scope of work.

D. Repair or replacement of damaged surfaces, fixtures, or furnishings due to the Contractor action. Damaged surfaces shall be restored to like new condition to the satisfaction of the Architect or PBCC Representative or MEC.

E. When the bid documents include lead and asbestos abatement items in the same spaces, typically windows, painted-over transite sheeting, and flashings, the work should be performed in the sequence and combinations that produce the most efficient results, minimize concentrated lead waste volume, and produce the least amount of total waste. That sequence will generally be:
   1. Cleanup and removal of lead dust, flakes, chips, peeling paint, and residues most likely to fail a TCLP test.
   2. Removal of asbestos materials and cleanup of visible residues.
   3. Removal of lead-bearing architectural components.
   4. Removal of non-friable asbestos items. If both asbestos and lead are on the same components, for example lead paint and asbestos-containing glazing compound, the components may be removed and disposed of with both the lead and asbestos-bearing items intact.
   5. Final cleanup and decontamination of the work space. Final air clearance (asbestos) and wipe samples (lead) may be performed concurrently.
   6. When lead and asbestos final decontamination processes are combined, the more stringent cleanup procedures shall apply for both.
   7. Waste disposal.
      a. Classified waste: loose paint flakes, chips, and dust; lead-specific cleaning supplies; contaminated soil; combined final decontamination supplies; disposable suits, gloves, head-covers, and foot-covers; other items that fail a TCLP test.
      b. Special waste: friable asbestos-containing waste materials and lead-contaminated waste that has passed TCLP or other RCRA tests.
      c. Construction and Demolition (C&D) debris: non-friable asbestos-containing waste materials (such as, but not limited to intact transite, mastics, packing, caulking); lead-bearing architectural components where the paint is in intact condition.
      d. All asbestos-containing or lead-bearing wastes, regardless of classification, shall be disposed in an IEPA-approved landfill within the State of Illinois to accept asbestos-containing or lead-bearing waste materials.

F. Compliance with all applicable laws, regulations, standards, and these specifications. In the case of a conflict, the contractor shall comply with the most stringent.

G. All licenses, accreditations, permits, fees, notifications, reports, or other documents required by law, regulation, this specification, or the bid documents.

H. Provide project closeout documentation to the Environmental Project Manager (EPM) within thirty (30) days after final clearance. This documentation shall include, but is not limited to, submittals specified elsewhere in the specifications.

1.05 LAWS, REGULATIONS AND STANDARDS

A. The following laws, regulations, and standards are incorporated by reference:
1. 29 CFR 1910 - US OSHA General Industry Standards
2. 29 CFR 1926 - US OSHA Construction Standards
3. 29 CFR 1926.1101 - US OSHA Asbestos Construction Standards
4. 40 CFR Part 61 - US EPA National Emissions Standards for Hazardous Air Pollutants (NESHAP), 11/90 revision
5. 40 CFR Part 763 Subpart E - US EPA Asbestos Model Accreditation Plan (MAP): Appendix C
6. 11-4-2170: Chicago Building Code- Demolition and renovation safeguards
7. 11-2-2150: Environmental Standards related to the demolition, renovation, asbestos abatement and maintenance, sandblasting, chemical wasting, and grinding of buildings facilities or other structures.

1.06 ASSESSMENT, MONITORING, TESTING AND ANALYSIS

A. The MEC will perform inspection, testing and design services prior to the start of work, and during the project, if necessary. The MEC will also perform testing, inspection, and monitoring services during the work and upon its completion:
1. Prior to the start of the work, the MEC shall
   a. Identify suspect materials and confirm their asbestos content through review of previous inspection documentation or by testing;
   b. Design the project and address any design changes as requested. Approved changes shall be submitted to the IDPH, when necessary.
2. During the work, the MEC shall:
   a. Observe the work periodically, with sufficient frequency to ensure Contractor compliance.
   b. Collect area air samples in and around the Work Area, as needed, to verify exposure conditions.
   c. Stop the work if airborne asbestos concentrations at the Work Area perimeter exceed 0.01 f/cc. Contractor shall be responsible for taking corrective action to reduce exposure levels and prevent recurrence; cleaning adjacent areas that become contaminated by the asbestos abatement activities.
   d. Make copies of contractor licenses from the originals.
   e. Complete design changes that are needed.
3. Upon completion of the work, the MEC shall:
   a. Visually inspect for visible dust and debris, and verify the full completion of the work.
   b. Require contractor to re-clean the area or portions of areas until no visible debris remains.
   c. Perform clearance air sampling at the completion of the work activities, when necessary.

B. The AC shall provide OSHA compliance air monitoring to determine exposures to its employees in accordance with OSHA 29 CFR 1926.1101. Frequency of monitoring shall comply with OSHA requirements for the anticipated and actual exposure levels.
1. A written Exposure Assessment with air sampling and analysis conducted 6 months or less prior to the start of the work to determine the requirements for respiratory protection and frequency of OSHA monitoring for each type of activity. The contractor should note that a Negative Exposure Assessment (NEA) may be possible for these tasks.
2. Analysis may be performed on site.

C. Credentials required for testing and analysis of Phase Contrast Microscopy air samples:
   1. Air sampling shall be conducted by an IDPH licensed Air Sampling Professional.
   2. Accreditation by AIHA or AAR; or
   3. Participation in the Proficiency Analytical Testing (PAT) program.

1.07 SUBMITTALS

A. The following shall be submitted to the MEC no less than 10 days prior to the start of the asbestos abatement work activities.

B. Ten (10) day NESHAP notification to the Illinois EPA when the asbestos quantities reach or exceed 260 linear feet or 160 square feet. Two (2) day IDPH notification with a copy to CDPH for asbestos abatement quantities less than 260 linear feet or 160 square feet. Submit ten (10) day CDPH notification for all asbestos work.
   1. Ten (10) day IEPA Asbestos Notification including inspector license number and landfill permit number.
   2. Evidence that all AC employees in the Work Areas are trained and accredited in accordance with OSHA, NESHAP, and EPA MAP requirements:
      a. Current Annual refresher training certificate.
      b. Current IDPH asbestos licenses
      c. Current physician's written opinion
      d. Current respirator fit test for negative pressure respirators when respirators are used.
   3. Copy of OSHA Exposure Assessment, with air sampling and analysis conducted 6 months or less prior to the start date of the abatement project.
   4. OSHA compliance air monitoring records generated during the project.
   5. Waste Shipment Records.
   6. Worker license and certification log.
   7. Safety Data Sheets (SDS) for chemicals used on site.
   8. Work Plan and Schedule.

C. Prior to beginning work, the AC shall submit required notifications to applicable regulatory agencies and receive an Owners Authorization and Notice to Occupants from the PBCC for buildings where asbestos abatement will take place.

D. The AC shall provide copies of all regulatory notices to the PBCC Representative, MEC, and the EPM within 24 hours of sending such notices to the regulatory authority. The AC shall not begin a project until such notices are provided to all parties listed above.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. All equipment shall at least conform to minimum industry standards:

B. Equipment:
   1. Respirators shall be NIOSH approved for use with lead, asbestos, or other contaminants anticipated in the work.
   2. Contractor is fully responsible for complying with OSHA rules for other Safety equipment, such as hard hats, safety harnesses, eye protection, gloves, footwear, and any other safety devices used on the site.

C. Tools:
   1. Ladders, scaffolding and all other rigging devices shall be constructed in a safe manor meeting all regulatory and permitting requirements.

2. Power tools such as, but not limited to saws, pneumatic chisels, brushes, sanders, and needle guns shall be equipped with shrouds and HEPA-filtered local exhaust systems to capture released particles. Power tools shall also be grounded using a Ground Fault Circuit Interrupter (GFCI) breaker or outlet.

2.02 MATERIALS

A. Installed materials which become a part of the work such as, but not limited to, encapsulants foam sealants and permanent enclosures shall be of good quality, non-lead-bearing, free of asbestos, and conform to the respective reinstallation specification sections.
   1. Contractor shall ensure that encapsulants and sealants used as primers, basecoats, fillers or covering existing materials are compatible with the respective existing or reinstallation materials and their manufacturers' warranties.

B. Abatement materials
   1. Poly sheeting for all applications shall be 6 mil nominal thickness.
   2. Tape shall be 2 inch or 3-inch duct tape or other waterproof tape suitable for joining poly seams and attaching poly sheeting to surfaces.
   3. Spray adhesives shall be non-flammable and free of methylene chloride solvents.
   4. Disposal bags shall be 6 mil.
   5. Disposable suits, hoods, and foot coverings shall be TYVEK or similar.
   6. Solvents shall be compatible with any primers, mastics, adhesives, paints, coatings, or other surfacing materials to be installed following their use.

PART 3 - EXECUTION

3.01 EMPLOYEE TRAINING, QUALIFICATION AND MEDICAL SCREENING

A. Supervisors and Workers shall be trained, accredited, and licensed in accordance with IDPH rules and regulations:
   1. Contractor shall keep copies of current licenses, initial training course certificate, and most recent annual refresher training certificate at the jobsite at all times for all contractor personnel.
   2. A Supervisor (competent person) shall be present at the work site at all times when work under the specifications is being conducted.

B. Medical Screening. All contractor personnel shall have a current medical examination in accordance with OSHA requirements. Copies of the Physician's Written Opinions shall be kept on site along with a current fit test certificate.

3.02 PERMISSIBLE EXPOSURE LIMITS

A. The OSHA permissible exposure limit (PEL) for worker exposure to airborne fibers is 0.1 f/cc as an 8-hour time-weighted average (TWA).

B. The OSHA short term excursion limit (STEL) for worker exposure to airborne fibers is 1.0 f/cc for a 30-minute sample.

3.03 EXPOSURE ASSESSMENT AND MONITORING

A. The AC shall make an assessment of the airborne exposures. Assessment shall conform to OSHA requirements and may be based upon:
   1. Initial monitoring of representative workers who the contractor believes are exposed to the greatest airborne concentrations of asbestos, or

2. Past monitoring (within the past 12 months) or objective data for conditions closely resembling the processes, type of material, control methods, work practices and environmental conditions to be used for these documents.
3. In the absence of an exposure assessment the contractor shall perform the work in full negative pressure containment with Type C pressure-demand respirator with auxiliary SCBA escape bottle.

B. The Contractor shall perform personal monitoring in accordance with the following requirements:
1. Initially, to establish an exposure assessment when past monitoring or objective data are not available for an initial determination.
2. Daily, if the exposures are, or are expected to be, above the PEL of 0.1 f/cc.
3. Periodically if the exposures are, or are expected to be, below the PEL.
4. Whenever there has been a change of equipment, process, control, personnel, or a new task has been initiated that may affect employee exposures, the exposure assessment shall be updated, and monitoring shall be reinstituted if exposures are unknown or are expected to exceed the PEL.
5. Area Monitoring is required at the perimeter of the Work Area to verify that exposures to adjacent areas are below the PEL.

3.04 RESPIRATORY PROTECTION

A. Respiratory protection shall be worn by all persons potentially exposed to airborne asbestos fibers from the start of the abatement project until air monitoring analysis results prove otherwise.

3.05 HYGIENE PRACTICES

A. Eating, drinking, smoking, chewing gum or tobacco, and applying of cosmetics are not allowed in the Work Area.

B. All persons entering the Work Area shall wear appropriate PPE.

C. When the use of a Personnel Decontamination Enclosure System is deemed necessary by the MEC, the AC shall follow all entry and exit procedures posted in the Personnel Decontamination Enclosure System.

D. Personal Protection Equipment (PPE) shall include:
1. Full body disposable suits, headgear, and footwear.
2. Gloves.
3. Hard hats.
4. Non-disposable footwear and clothing shall remain in the Work Area and shall be disposed of as contaminated waste when the job is completed.
5. Authorized visitors shall be provided with suitable PPE when required in the Work Area.
6. PPE is required when exposures are, or are expected to be above the PEL.

E. A Personnel Decontamination (decon) Facility is required when worker exposures are expected to be above the PEL. The Decontamination unit may be remotely located if not feasible to locate adjacent to the Work Area.
1. Establish a negative pressure of at least 0.02 inch water column between the dirty equipment room and adjacent spaces, including the clean room. Assume Negative Air Machines (NAM) operate at 80% design capacity.
2. Provide at least 4 air changes per hour within the decon unit
3. All personnel shall use a double-suiting procedure for traveling between Work Areas and decon. Persons shall HEPA-vacuum the exterior of their disposable suits at the entry to

the Work Areas, put on a clean suit over the existing suit, and proceed to the decon unit for shower decontamination and change into street clothes.

F. To exit, persons shall HEPA-vacuum down clothing at the Work Areas entry, and leave the Work Areas. When disposable suits are used, they shall be HEPA-vacuumed, stripped off, and deposited in an asbestos disposal bag. Personnel may then leave the Work Areas.

3.06 PROHIBITED ACTIVITIES

A. Dry removal or dry sweeping, except:
   1. During freezing weather. In this case, temperature and weather conditions must be recorded at the start, during, and at the end of the shift.
   2. On roofs with 3:1 slope or greater. In this case, roofing shall be removed in an intact condition, as much as possible.
   3. When equipment damage or other hazard exists. In this case, written permission from IEPA is required prior to performing dry removal.

B. Use of compressed air for cleaning.

C. Use of high speed power tools not equipped with a HEPA-filtered local exhaust system.

D. Removing respirators or other PPE in the Work Areas.

3.07 WORK AREAS ISOLATION AND PREPARATION

A. General Preparation
   1. Post caution signs meeting the specifications of OSHA 29 CFR 1926.1101 (k)(6) at any location and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels.
   2. Secure the Work Areas from entry by unauthorized persons.

B. Exterior Preparation
   1. 6 mil plastic sheeting shall be placed over the ground, foundation, or other surfaces below the abatement area.
   2. Unauthorized entry shall be prevented by using appropriate barriers, such as warning tape, fencing, or other suitable barriers.
   3. Nearby air intakes, grilles, windows, and other openings into the building interior above, below, or beside the Work Areas that could be exposed to released airborne dust shall be closed or otherwise sealed off with poly and tape.
   4. All electric power in the Work Areas shall be protected with Ground-Fault Circuit Interrupters.

3.08 ABATEMENT PROCEDURES

A. General Removal Requirements:
   1. Asbestos materials shall be wetted and kept wet during removal.
   2. ACM shall be bagged or containerized as it is removed. Wastes shall not be dropped or thrown to the ground. Unless the material is carried or passed to the ground by hand, it shall be lowered via covered, dust-tight chute, crane, hoist, or other means that prevent the wastes from being dropped or thrown.
   3. Appropriate OSHA protection shall be provided when working from exterior access:
      a. Scaffolding shall be equipped with handrails and mid-rails designed to provide fall protection, or full-body safety harnesses shall be worn and tied off to a secure anchor point.

b. Workers in man-lifts shall wear full body harnesses and tie to the tie-off point provided on the man-lift basket whenever the basket is elevated from ground level.
c. The contractor shall ensure that scaffolding, man-lifts and the workers erecting and using the equipment meet all federal, state and local regulations and requirements including the acquisition of all required permits for the erection and use of such equipment.

B. Window Replacements: Asbestos-containing materials are most likely to be found in exterior caulking and glazing putty. Windows may be removed under the specifications if ACM is handled from the building exterior. If ACM materials must be accessed from inside the building or ACM wastes must be transported through the building interior, then IDPH-regulated requirements shall apply at no additional cost to the PBC. Refer to Division 02 Section "Asbestos Abatement - Interiors" if interior work is necessary. For exterior work:
1. Close windows and seal from the inside by covering with 6 mil poly and tape, or by applying tape directly to window joints and seams.
2. Any ACM not required to be disturbed for window removal should be left in place (e.g. window pane glazing).
3. ACM that must be disturbed (e.g. caulking at the edge of the window frame) must be removed completely, including three-dimensional residues.
4. Collect debris and deposit in asbestos waste bags as the work proceeds. Do not allow wastes to accumulate on surfaces.
5. Abate ACM and LBP on all window components to remain in place.

C. Roofing:
1. General: Remove ACM roof mastics, cements, underlayments, and flashings in an intact state to the extent feasible. Asbestos-containing shingles may occasionally break even when removed carefully. The fact that otherwise intact roofing materials become separated or broken does not by itself render them non-intact. However, if they become pulverized, reduced to powder or dust, they have become non-intact.
   a. The Contractor shall take care to minimize the amount of roofing material damage, or;
   b. If the materials are rendered non-intact, the Contractor shall employ methods to contain the dust and debris and utilize hygiene practices appropriate for friable (OSHA Class I) ACM, including PPE, decontamination units, and monitoring. Monitoring may include area samples at the Work Areas perimeter to determine that airborne asbestos fibers are not being released in concentrations above the PEL.
2. Built-up roofing and asphalt shingles:
   a. Power cutting machines shall be equipped with a HEPA-filtered dust collection system and shall be misted during use.
   b. Dust generated by the cutting operation shall be collected with HEPA vacuums or wet cleaning methods.
3. Rigid roofing materials, such as cement asbestos shingles: remove intact and minimize breakage.

D. Transite, Galbestos sheeting (galvanized metal with a baked-on asbestos paint), Asbestos/Cement pipe, or other rigid panels shall be removed using wet methods.

E. Other
1. Non-LBP and other coatings, electric cable insulation or joint coverings, and other miscellaneous materials that are to be removed with the substrate or that can be removed without becoming friable may be removed as intact (OSHA Class II, EPA NESHAP Category I or II non-friable) in accordance with procedures described in General Removal Requirements and Roofing paragraphs above.
2. Non-LBP, coatings, and other miscellaneous materials that must be removed from the substrate or that otherwise will become friable must be removed as non-intact (OSHA

Class I, EPA NESHAP friable) in accordance with procedures described in General Removal Requirements and Roofing paragraphs above.

3.09 CLEANING AND DECONTAMINATION

A. All visible accumulations of ACM, debris, tools, and unnecessary equipment shall be removed from the Work Areas.

B. Protective poly shall be folded in on itself, rolled up, placed in asbestos disposal bags, and disposed as asbestos waste.

C. Surfaces which have been exposed to friable ACM or its dust shall be HEPA vacuumed

D. Dry sweeping of surfaces which have been exposed to friable ACM or its dust is not permitted.

3.10 FINAL CLEARANCE

A. Cleaning may be discontinued when there is no visible debris and area air monitoring verifies that exposures are below the PEL. If any area air monitoring analysis results demonstrate results are at or above the PEL, the AC is responsible for repeating the cleaning as necessary until tests are satisfactory. All expenses associated with the collection and analyses of additional air monitoring tests are the responsibility of the AC.

3.11 WASTE DISPOSAL AND EQUIPMENT LOAD-OUT

A. Roofing waste may be loaded in bulk into lined enclosed receptacles, such as dumpsters or trailers. Receptacles shall be closeable and lockable to provide security and to prevent air emissions.

B. Packaged asbestos wastes:
   1. Asbestos-containing wastes, including removed ACM and debris, poly, critical barrier materials, suits, respirator filters, vacuum HEPA filters, water filters, and other asbestos-containing items shall be properly packaged for disposal.
   2. Use 6 mil plastic bags with gooseneck seal, or other impermeable containers.
   3. Wrap large or irregular items in 6 mil poly sheeting and seal with tape.
   4. Sharp, jagged, or other items that may puncture poly shall be packaged in rigid impermeable containers such as drums or boxes, or wrapped in burlap or other protective covering before sealing in bags or poly sheeting.
   5. Label containers for friable ACM waste:
      a. OSHA warning label.
      b. DOT performance-oriented hazardous material label.
      c. Name and address of generator and abatement location.

C. Removing items from the Work Areas:

D. Packaged asbestos wastes shall be HEPA-vacuumed before removing from the Work Areas.

E. Storage of packaged asbestos wastes shall be in a completely enclosed dumpster, or other suitable container that can be secured. The secured area shall be kept locked at all times to prevent unauthorized access.

F. Shipment of items from the project.
   1. Decontaminated tools and equipment may be shipped by normal carrier to warehouse, another jobsite, or other destination.
   2. For asbestos wastes:

a. Line enclosed shipping container with 6 mil poly prior to loading packaged friable asbestos wastes.
b. Post NESHAP placards during loading of friable asbestos wastes.
c. Execute the NESHAP-required Waste Shipment Record (WSR) to be signed by the generator, transporter, and landfill. All WSRs shall be returned to the MEC within 30 days of shipment.
d. ACM waste shall be transported from the work site directly to the landfill.

G. Disposal of packaged asbestos wastes.
1. Only landfills approved and permitted for accepting asbestos wastes may be used for disposal.

H. A punch list walk-through shall be conducted for each cleared Work Areas within two working days of clearance testing by the MEC, Contractor, and AOR. All punch list items shall be completed within five working days of walk through.

END OF SECTION

SECTION 02 86 13

HAZARDOUS AND UNIVERSAL WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. These environmental requirements apply to all PBCC projects. These specifications apply for all demolition, construction and renovation projects that require the removal and disposal of hazardous and/or universal waste in accordance with all applicable regulations.

B. This Section describes the segregation, packaging, labeling, transport, and disposal and/or recycling of hazardous and universal waste materials generated by demolition/renovation activities and the subsequent shipment of properly packaged and labeled waste materials to open, permitted and Owner-approved disposal sites.

C. The Contractor's Work includes work area preparation, sampling and analysis, on-site handling, supervision of all Work, preparation of reports, protection of on-site persons, utilities, and property, and payment of all transport and disposal/recycling fees.

1.02 DEFINITIONS

A. In addition to the terms listed below, all definitions in the laws and regulations specified elsewhere in the specifications are incorporated by reference, whether or not restated herein.

B. Capacitor: device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by dielectric fluid.

C. CFR: the Code of Federal Regulations, is the basic component of the Federal Register publication system. The CFR is a codification of the regulations of the various Federal Agencies.

D. Chemical Waste Landfill: an open and approved landfill, permitted under 35 IAC Subtitle G Part 814 at which protection against risk of injury to health or the environment from migration of PCBs to land, water or the atmosphere is provided from PCBs and PCB items deposited therein by locating, engineering, and operating the landfill as specified in 40 CFR 1761.75.

E. Component: all removable parts/materials which make up ballasts, bulbs, batteries, and other electrical equipment, a percentage of which can be recycled.

F. Container: any portable device, in which material is sorted, transported, treated, disposed of, or otherwise handled.

G. Contractor: the entity responsible for performing the complete scope of work in the Documents. The Contractor may elect to self-perform or subcontract out any portion of the work.

H. Disposal: to intentionally or accidentally discard, throw away or otherwise complete or terminate the useful life of PCBs and PCB items. Disposal includes spills, leaks, and other uncontrolled discharges of PCBs as well as actions related to containing, transporting, destroying, degrading, decontaminating, or confining PCBs and PCB items.

I. Disposal Facility: a facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

J. EPA Identification: the unique number assigned by the EPA to each generator or transporter of hazardous waste, and each treatment, storage or disposal facility.

K. Facility: all contiguous land, structures, other appurtenances, and improvements on the land, used for treating, storing or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units, e.g. one or more landfills, surface impoundments, or a combination of them.

L. Fluorescent light ballast: a device that electrically controls fluorescent light fixtures and that includes a capacitor containing 0.1 kg or less of dielectric.

M. Leak or Leaking means any instance in which PCB, chemical, hazardous or universal waste Article, Container or Equipment has any PCB, chemical, hazardous or universal waste residue on any portion of its external surface or surrounding area.

N. PBCC: Public Building Commission of Chicago, the Owner of the property and the authority ordering the Work specified herein.

O. PBCC Representative: the entity responsible for overall project coordination and completion.

P. On-site: within the boundaries of a contiguous property unit.

Q. OSHA: the federal Occupational Health and Safety Administration.

R. Landfill: an open and permitted disposal facility or part of a facility where hazardous and special wastes are placed in or on land and which is not a land treatment facility, a surface impoundment, or a combination of them.

S. Managing Environmental Consultant (MEC): the entity with overall responsibility for the environmental aspects of the project, including design, organization, direction, oversight and control as well as investigations, assessments, and supervision of project manager.

T. Manifest: the shipping document, EPA form 7710-53, used for identifying the quantity, composition, origin, routing, and destination of hazardous waste during its transportation from the point of generation to the point of treatment, storage or disposal.

U. Polychlorinated Biphenyls (PCBs): any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance.

V. PCB Article Container: any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCB Articles or PCB Equipment, and whose surface(s) has not been in direct contact with PCBs.

W. PCB Container: any package, can bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surface(s) has been in direct contact with PCBs.

X. PCB Item: any PCB Article, PCB Article Container, PCB Container, or PCB Equipment, that deliberately or unintentionally contains or has as a part of it any PCB or PCBs.

Y. Recover Refrigerant: to remove refrigerant in any condition from an appliance without necessarily testing or processing it in any way.

Z. Recycle Refrigerant: to extract refrigerant from an appliance and clean refrigerant for reuse without meeting all of the requirements for reclamation. In general, recycled refrigerant is

refrigerant that is cleaned using oil separation and single or multiple passes through devices such as replaceable-core filter-driers, which reduce moisture, acidity, and particulate matter.

AA. Reclaim Refrigerant: to reprocess refrigerant to at least the purity specified in Air-Conditioning and Refrigeration Institute (ARI) Standard 700-1988, “Specification for Fluorocarbon refrigerants”, and to verify this purity using the analytical methodology prescribed in the standard. In general reclamation involves the use of processes or procedures available only at the processing or manufacturing facility.

BB. Storage: the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, destroyed, disposed of or stored elsewhere.

CC. SDS: Safety Data Sheets, required by OSHA for any chemical in the workplace that that could be expected to cause an exposure to workers during normal use or in emergency situations.

DD. Toxic Characteristic Leaching Procedure (TCLP): a laboratory test method to determine the mobility of both organic and inorganic compounds present in liquid, solid, and multiphasic wastes performed in accordance with test methods required under 40 CFR Part 261 and 268.

EE. Transporter: any person engaged in the off-site transportation of special waste and/or hazardous waste within the United States, by air, rail, highway or water, if such transportation requires a manifest under 40 CFR Part 262.

1.03 SCOPE OF WORK

A. The work includes all labor, equipment, materials, and supplies necessary to perform the Scope of Work in the bid documents by the procedures described herein. The Contractor, by submitting a bid for the work, represents itself as knowledgeable and expert in the performance of the work, and includes all things usually and customarily necessary to provide a complete and finished job, whether specifically mentioned or not.

1.04 QUALITY ASSURANCE

A. Work outlined in this Section must be performed by a qualified Contractor, with a minimum of 10 years’ experience, who is thoroughly familiar with working with regulated waste materials of similar size and scope, the Contractor must be familiar with and capable of complying with all federal, state, and local regulatory requirements pertaining to waste handling.

B. Medical Examinations: The Contractor shall provide workers with a comprehensive medical examination as required by 29 CFR 1910.134 and 29 CFR 1926.62. The examination will not be required if adequate records show that employees have been examined as required within the last year. The Contractor shall institute a medical surveillance program for all employees who are or may be exposed above the action level for more than 30 days per year.

1.05 LAWS, REGULATIONS, AND STANDARDS

A. The Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to hazardous, special and universal waste management and disposal/recycling.

B. Federal Requirements:
   1. Federal requirements which govern the management, hauling and disposal of hazardous, special and universal waste/recycled material include but are not limited to the following:
      a. DOT: U. S. Department of Transportation, including but not limited to the following:

1) Hazardous Substances, Title 49, Part 171 and 172 of the Code of Federal Regulations.
2) Hazardous Material Regulations, General Awareness and Training Requirements for Handlers, Loaders and Drivers,
3) Title 49, Parts 171-180 of the Code of Federal Regulations.
4) Hazardous Material Regulations, Editorial and Technical Revisions, Title 49, Parts 171-180 of the Code of Federal Regulations.
   a) EPA: U. S. Environmental Protection Agency (EPA), including but not limited to the following:
   Management of Hazardous Wastes Resource Conservation and Recovery Act (RCRA), Title 40, Parts 260-299 of the Code of Federal Regulations.
   Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution In Commerce, and Use Prohibitions, Title 40, Parts 761, of the Code of Federal Regulations.
   Protection of Stratospheric Ozone, Title 40, Part 82 of the Code of Federal Regulations.
   Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Title 42, Section 103.
   Universal Waste Rule, Title 40, Part 273 of the Code of Federal Regulations.
   b) LABOR: Occupational Safety and Health Administration, including but not limited to:
   Occupational Safety and Health Guidelines, Respiratory Protection, Title 29, Part 1910.134.
   Occupational Safety and Health Guidelines, Occupational Safety and Health Standards, Lead, Title 29, Part 1910.1025.
   Occupational Safety and Health Guidelines, Occupational Safety and Health Standards, Hazard Communication, Title 29, Part 1910.1200.
   Safety and Health Guidelines for Construction, Title 29, Part 1926 of the Code of Federal Regulations.

C. State Requirements: Abide by all state requirements which govern the management, hauling and disposal of hazardous, special and universal waste/recycled material. In Illinois, this includes, but is not limited to the following:
   1. Title 35 of the Illinois Administration Code (IAC), including but not limited to the following:
      a. Wastestream Authorization, IAC Chapter I, Subpart b, Part 709.
      b. Hazardous Waste Management Systems: General, IAC Chapter I, Subchapter c, Part 720.
      c. Identification & Listing of Hazardous Waste, IAC Chapter I, Subchapter c, Part 721.
      d. Standards Applicable to Generators of Hazardous Waste, IAC Chapter I, Subchapter c, Part 722.
      e. Standards Applicable to Transporters of Hazardous Waste, IAC Chapter I, Subchapter c, Part 723.
      f. Standards Applicable to Treaters, Storers, and Disposers of Hazardous Waste, IAC Chapter I, Subchapter c, Part 724.
      g. Interim Status Standards of Hazardous Waste Treaters, Storers, and Disposers, IAC Chapter I, Subchapter c, Part 725.
      h. Standards for the Management of Specific Hazardous Waste and Specific Types of Hazardous Waste Management Facilities, IAC Chapter I, Subpart c, Part 726.
      i. Land Disposal Restrictions, IAC Chapter I, Subchapter c, Part 728.
      j. Universal Waste Management, IAC Chapter I, Subchapter d, Part 733.
      k. Solid Waste, IAC Chapter I, Subchapter i, Part 807.
      l. Special Waste Classifications, IAC Chapter I, Subchapter i, Part 808.

m. Special Waste Hauling, IAC Chapter I, Subchapter i, Part 809.
n. Standards for New Solid Waste Landfills, IAC Chapter I, Subchapter i, Part 811.
o. Procedural Requirements for Permitted Landfills, IAC Chapter I, Subchapter i, Part 813.
p. Standards for Existing Landfills and Units, IAC Chapter I, Subchapter g, Part 814.
q. Standards for Management of Used Oil, IAC Chapter I, Subchapter e, Part 739.

D. Local Requirements: Abide by all local requirements as outlines within the Municipal Code of the City of Chicago which governs the management, hauling, and disposal of hazardous, special and universal waste/recycled material.

1.06 SUBMITTALS

A. Before start of any hazardous waste removal Work, the Contractor must submit a Hazardous Waste Management Plan to the MEC fifteen (15) days prior to the start of Work.

B. During the Work, the Contractor must submit the following to the MEC, with ten (10) days of activity, off-site removal, or completion of work if duration is less:
1. TCLP test results, as required to characterize waste paint chip debris for segregation and packaging purposes prior to transport from the site.
2. Submit copies of all executed manifests and disposal site receipts and waste quantities within ten (10) days to the MEC.
3. Receipts for all recycled materials accepted at authorized recycling facilities. The receipts will include the number of components recycled as well as the amount of materials recycled and/or disposed.
4. Documents for the removal, handling, recycling or disposal of CFC Refrigerant/Reclamation.
5. Daily Reports - list names of active workers for each day, work starting and stopping times, visitors to the site, and description of Work accomplished.

C. Submittal Review:
1. Review of submittals or any comments made do not relieve the Contractor from compliance with the requirements of the contract specifications and drawings. The purpose of this check is to review for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents.
2. The Contractor must not begin any Work applicable to this section until all required submittals have been reviewed and accepted by the MEC.

1.07 HAZARDOUS WASTE PLAN REQUIREMENTS

A. General Applicability of Codes and Regulations:
1. Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable codes and regulations have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.

B. Contractor Responsibility:
1. Notice shall be provided to the PBCC Representative a minimum of 2 working days prior to the removal of any hazardous, special or universal waste and/or recycled hazardous, special or universal waste from the site.
2. Notice will be provided to the PBCC Representative within 4 hours of any environmental problems, complaints, fines, citations or issues by any government body or regulatory agency pertaining to hazardous, special or universal waste management and disposal. Written confirmation will be provided to the Board Representative within 48 hours of the incident that indicates that all problems and issues have been satisfactory addressed.

C. The Contractor must prepare a Hazardous Waste Plan designating appropriate procedures and equipment for performing the Work. The Hazardous Waste Plan must address the proper management/handling and disposal/recycling of wastes generated during Work activities. The Contractor's Hazardous Waste Plan for this project must include as a minimum the items listed below:

1. List of Hazardous Waste Equipment:
   a. A description of the proposed equipment to be used during the removal, handling, temporary storage and transport of hazardous materials related to the Work.
   b. Hazardous Material Handling:
      1) Procedures including a description of the method of transportation and storage of each type of hazardous material, for movement on and off site.
      2) Contractor shall provide a description of procedures for on-site characterization of chemicals for consolidation prior to disposal/recycling.
      3) 3The plan will include the following documentation for each transporter:
         a) A copy of state and local special waste and/or hazardous waste hauler licenses for each transporter must be provided in the Plan.
         b) U.S. EPA Identification Number of waste hauler.
         c) Current list of all transporting vehicles to be used including:
         Vehicles make, model and year.
         Serial number for each vehicle.
         Vehicle license number.
         Number of axels.
         Weight capacity of vehicle.
         d) A list of all licensed qualified truck drivers. Drivers should be able to provide their driver's license upon request.
         e) Instances where rail haulers are being used, copies of all applicable permits and licenses for the load on/off site location(s) and/or transfer location(s) will be provided.
      4) Contractor shall provide the following documentation for each disposal/recycling facility:
         a) Name and address of waste disposal facility where hazardous waste materials are to be disposed including:
         Contact person and telephone number.
         Copy of state license and permit.
         Disposal facility permits.
         b) A signed statement from an authorized representative of the recycling or disposal facility stating the percentage of recycled materials for each of the components including the estimated percentage pertaining to each component which has no recycling value.
      5) Safety Precautions -Personnel:
         a) List safety equipment and clothing to be used per OSHA regulations.
         b) A description of emergency procedures to be followed in case of physical contact, ingestion, inhalation, etc.
      6) Emergency Spills:
         a) A description of methods to be used for containment.
         b) A description of methods to be used for collection and disposal.
         c) A description of methods and materials to be used to restore areas harmed by emergency spills.
      7) Lead-containing Paint Management:
         a) A description of the work procedures that will be utilized to minimize the generation of airborne lead into the environment.
      8) In addition, the Plan will provide:
         a) Specimen copy of Uniform Hazardous Waste Manifest form.
         b) Copy of EPA "Notice of Hazardous Waste Activity" form.

c) Copy of forms and permits required by federal, state, and local agencies.
d) Sample of disposal label(s) to be used.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Disposal Bags: Provide 6 mil (0.15 mm) thick leak-tight polyethylene bags.

B. DOT Hazardous Waste Disposal Drums: Provide DOT 17-H Open -Top Drums (55-gallon) in accordance with DOT title 49 CFR Parts 173, 177, 178, and 179.

C. Fiberboard Drums, cylindrical containers manufactured from sturdy fiberboard will be utilized for storage transportation of electrical equipment.

D. PCB containing ballasts shall be place in 55-gallon drums with vermiculite packing. The drums will be sealed and labeled as containing hazardous PCB waste. The label shall also include the name and address of the parcel. However, if ballasts are damaged they shall be stored prior to disposal in accordance with 40 CFR 761.65.

E. DOT Hazardous Waste Labels: in accordance with DOT regulations Title 49 CFR parts 173, 177, 178, and 179.

F. Corrugated “Gaylord” Boxes with the use of a liner will be used to store and transport bulk materials which will be kept on pallets during storage and transportation.

G. Materials to be used to restore areas harmed by emergency spills.

H. Safety equipment and associated clothing to be used.

I. Hazardous material manifests and other related forms required by state and local agencies.

J. Utilize equipment to recover refrigerant that is appropriate for the following:
1. Type of system encountered
2. Refrigerant type
3. Achieving IEPA-mandated vacuum levels

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contractor shall train each employee performing Work prior to the time of initial job assignment in accordance with applicable regulations.

B. Respiratory Protection Program:
1. The Contractor shall furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every 6 months thereafter if required by 29 CFR 1910.1025.
2. The Contractor shall establish and implement a respiratory protection program as required by 29 CFR 1910.134 and 29 CFR 1926.62.

C. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.

D. Post warning signs at entry points to hazardous Work area, as necessary.

E. Segregate, package, label, transport and dispose of Hazardous Waste in accordance with DOT, EPA, state, and local regulations.

F. Scheduling/Sequencing of the demolition and/or abatement is to be coordinated by the Contractor.

G. Contractor shall decontaminate all residues from all surfaces where pre-existing leaks occur. Contractor shall decontaminate all surfaces where leaks occur during the removal and disposal process.

H. Extreme care shall be used to prevent leakage of chemicals, liquid wastes, refrigerant, etc. during removal processes.

I. Do not mix potentially hazardous waste streams or different refrigerants in the same recovery vessel. Where feasible, separate each type of hazardous waste from other types of hazardous wastes and construction waste.

J. All electrical circuits shall be de-energized and locked out prior to removal of ballasts. Contractor shall provide temporary lighting as needed.

K. The Contractor shall identify the location and Commissionership of all on-site transformers. The contents from each transformer shall be characterized for PCB content by the Contractor for proper disposal.

L. The Contractor shall determine location and type of each radiological waste. The Contractor shall make all arrangements from the proper decommissioning of equipment and disposal of related materials.

3.02 HAZARDOUS WASTE DESIGNATION

A. Where not otherwise designated by the Owner as hazardous waste, characterize applicable suspect waste products by conducting representative TCLP testing and referencing 40 CFR Part 261.

B. Work shall include characterization and proper disposal of any soot contained within boilers, incinerators, or stacks; maintenance fluids within heating/cooling equipment; hazardous chemicals; storage tanks; or lead content of paint present.

C. Fluids from transformers, electrical equipment, hydraulic equipment, etc. shall be characterized for PCB content per 40 CFR Part 761.

D. Representative sampling of waste products will be in accordance with EPA Document SW 846.

E. TCLP test analysis will be performed in accordance with EPA Method 1311.

F. Radiological Wastes shall be classified in accordance with the NRC operating agreement.

3.03 HAZARDOUS WASTE

A. The following waste products are designated by the Owner as non-salvageable and as Hazardous Waste Types:
   1. Waste Type A: PCB waste.
      a. PCB-containing ballasts from fluorescent light fixtures.

b. PCB-containing electrical transformers and switch gears.
c. PCB-containing hydraulic fluid, which can be found within but not limited to the following equipment:
    1) Hydraulic-lift elevators
    2) Hydraulic trash compactors
    3) Hydraulic loading dock lifts
    4) Waste Type B: Mercury-containing waste.
        a) Thermostats with mercury switches. Individually bagged mercury-containing thermostats.
        b) Fluorescent and mercury-vapor lamps/bulbs.
        c) Thermometers.
        d) Gauges and regulators (including those found in waste medical equipment).
        e) Elemental mercury.
    5) Waste Type C: Medical Waste.
        a) Used and unused sharps.
        b) Contents of bio-hazard waste containers, including drums and bins.
        c) Surplus medical supplies.
        d) Contents of medical devices, such as dialysis machines, ventilators.
        e) Human and animal pathological wastes including tissue samples stored on slides and preserved and unpreserved specimens.
    6) Waste Type D: Chemical Wastes.
        a) Cleaning chemicals such as bleach, ammonia, carpet cleaner, etc.
        b) Laboratory chemicals such as xylenes, benzene, acetic acid, dyes, formaldehyde, etc.
        c) Boiler and water treatment chemicals.
        d) Developing chemicals associated with the processing of x-rays and other photographic images, both used and virgin product.
        e) Unused medicine.
        f) Building maintenance chemicals such as paint, adhesives, glazing compound, caulk compound, roofing materials, concrete binder, resurfacing compounds, etc.
        g) Equipment maintenance chemicals such as lubricants, solvents, and oils.
        h) Fuels, such as gasoline, No. 2 Fuel Oil, and diesel fuel.
        i) Equipment and vessels containing chemicals, such as fire extinguishers, gas cylinders, batteries, and film developing equipment.
    7) Waste Type E: Refrigerants and CFCs
        a) Refrigerators and freezers.
        b) Air Conditioning units.
        c) Cryogenic Supplies.
        d) Bulk storage of refrigerants.
    8) Waste Type F: Equipment
        a) Mechanical equipment, such as compressors, generators, compressors, water conditioning vessels, motors, etc.
        b) Electrical equipment such as televisions, computers, monitors, current controllers, etc.
        c) Medical equipment such as vital signs monitors, incubators, crash carts, MRIs, ultrasounds, ventilators, dialysis machines, etc.
    9) Waste Type G: Radiological Waste
        a) Drummed Radioactive waste.
        b) Equipment that uses a radioactive source including x-rays, mammograms, CAT scans, electron microscopes, scintillation spectrometers, etc.
        c) Smoke detectors.

10) 1Waste Type H: Lead-containing waste.
    a) Lead paint (liquid or containerized paint wastes).
    b) Lead-contaminated wastes (paint chips, loose debris, etc.).
11) 1Waste Type I: Other
    a) Drums of hazardous waste generated prior to the start of the contract.
    b) Wastes accumulated in Crock Pots.
    c) Lab trap drain wastes.
    d) Soot encountered in stacks, incinerators, or associated equipment.

3.04 HAZARDOUS WASTE PACKAGING AND LABELING

A. Package each segregated Hazardous Waste Type in containers for offsite removal and disposal/recycle. IMPORTANT: Do Not Mix Waste Streams.
   1. Waste Types A, B, C and I, as applicable:
      a. Package in DOT 17-H Open-Top Drums polyethylene disposal bag liners in accordance with 49 CFR Parts 171-180.
      b. Fill to capacity only with waste.
      c. Install gasket on lid, apply lock ring, and seal.
      d. Apply Hazardous Waste Label to drum side.
      e. Enter required DOT shipping data per applicable regulations.
      f. Adjacent to each label, enter the date indicating when waste was first placed in each drum.
         1) Waste Type D - Chemical Wastes:
            a) Package other wastes as applicable in accordance with Hazardous Wastes Resource Conservation and Recovery Act (RCRA), Title 40, Parts 260-299 of the Code of Federal Regulations. Overpack drums shall be required as necessary to complete Work.
         2) Waste Type E - Refrigerants and CFCs:
            a) Reference Section 3.8 for details.
         3) Waste Type F - Equipment:
            a) Package all equipment in closable and lockable containers for off-site removal. Ensure that all liquids, gases or other regulated materials are removed from equipment, as applicable, prior to placement in containers. Comply with all DOT regulations for each type of equipment.
         4) Waste Type G - Radiological Wastes:
            a) All radiological equipment shall be packaged and shipped in accordance with 32 IAC 341 regulations.
         5) Waste Type H - Lead-containing Wastes:
            a) Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265.
            b) Comply with land disposal restriction notification requirements as required by 40 CFR 268.
            c) Non-hazardous waste may be disposed of as demolition debris (general refuse).
            d) Submit results of TCLP testing to the EC prior to disposal.

B. Sealed and Labeled Containers: maintain all containers in a continuously sealed condition after they have been sealed.
   1. Do not reopen sealed containers
   2. Do not place additional waste in sealed containers.

3.05 TEMPORARY STORAGE

A. Partially filled containers of hazardous waste may be stored at the Work site for intermittent packaging provided that the following conditions are met:
   1. Each container is properly labeled when it is first placed in service, including the date;
   2. Each container remains closed at all times except when compatible waste types are added;
   3. Each Work site must be secured and/or attended at all times; and
   4. When moved from site to site, each container remains within the geographic boundaries of the facility without moving nor crossing public access highways; and
   5. UNDER NO CIRCUMSTANCES WILL THE ACCUMULATED WASTE REMAIN ON SITE BEYOND NINETY (90) DAYS FROM THE DAY THAT ACCUMULATION IN THE CONTAINER WAS INITIATED.

3.06 REMOVAL OF HAZARDOUS WASTES

A. Immediately seal containers of hazardous waste as each the container is filled. Remove containers of hazardous waste from the Work site within forty-eight (48) hours of being filled.

B. Transporting filled containers from the Work site to an approved disposal site or recycling center utilizing licensed hauler.

C. All fluorescent light ballasts shall be removed. Those labeled “NO PCBs” shall be packaged separately from those which indicate PCB or do not indicate PCB condition.

D. Subject to the PBCC Representative’s approval, the Contractor shall arrange with the electric utility provider for the removal of transformers which are owned by the utility provider from the site.

E. Subject to the Commission Representative’s approval, the contractor shall remove and dispose of all transformers which are not owned by the electric utility provider.

F. Continuously maintain custody of all hazardous material generated at the Work site including security, short-term storage, transportation and disposition until custody is transferred to an approved disposal site or recycling center.

G. Do not remove, or cause to be removed, hazardous waste from the Property without a legally executed Uniform Hazardous Waste manifest.

H. At completion of hauling and disposal of each load, submit copy of waste manifest, chain of custody form, and landfill receipt to the PBCC Representative.

3.07 RECYCLING AND RECOVERY

A. Turn over waste which contains materials for which recovery and/or recycling is possible to an approved recycling center. Materials subject to recycling include, but are not limited to:
   1. Fluorescent light tubes.
   2. Lead acid batteries.
   3. Combustible lead-based painted building components and lead-based paint chips.
   4. Televisions and computers.
   5. Ethylene Glycol or other related fluids found within cooling systems.
   6. Mechanical and medical equipment.
   7. Non-PCB-containing oils.
   8. Fuel.
   9. Maintenance chemicals.

10. Gas cylinders and fire extinguishers.
11. Lead Shielding Materials.

3.08 STORAGE & TRANSPORTATION OF REFRIGERANTS / CFCS

A. Use proper storage vessel when recovering refrigerants.
   1. IDOT containers meeting the ARI standard.
   2. Container working pressure rating must comply with IDOT requirements (49 CFR).
      a. For Refrigerant HCFC-22: Minimum working pressure rating of 260 psig.
      b. For Refrigerant CFC-11 (Low-Pressure Refrigerants): Drums of steel construction and designated as 17C or 17E.
         1) Open top and plastic drums shall not be used.
         2) Previously filled, disposable cylinders shall not be used to store or transport recovered refrigerants.

B. All recovery vessels shall be visually inspected by the Contractor prior to filling. The Contractor shall inspect and provide the following upon request:
   1. Verification of proper IDOT specification.
   2. Pressure rating verification.
   3. Current hydrostatic test date.
   4. Cylinder shall be free of surface dents and imperfections.

C. Provide required labeling for recovery vessel.

D. Return all refrigerant to reclamation facilities to be reprocessed to ARI 700 1988 Standards or dispose in an approved facility.

E. The Contractor shall provide the Commission representative with required documents for CFC Refrigerant/Reclamation within ten (10) days.

3.09 REMOVAL OF NON-HAZARDOUS WASTE MATERIAL

A. Transport and legally dispose of non-hazardous waste products, materials, residues and refuse at a location not on City’s property.

B. Non-hazardous waste products, materials, residues and refuse include, but are not necessarily limited to:
   1. Materials which are determined to be non-hazardous wastes through objective sampling in accordance with EPA Document SW-846 and laboratory analysis in accordance with EPA Method 1311.
   2. Emptied hazardous material containers: containers holding a material with constituents listed on the SDS as hazardous.
      a. When a container is emptied of its hazardous contents by pouring or scraping so that less than one inch of material remains in the bottom of the container, the container is considered “empty” and is not in itself a hazardous waste.
      b. Emptied hazardous material containers may be disposed of as construction debris waste (i.e. non-hazardous).
         1) Personal protective clothing and safety equipment with de minimis or trace contamination.

C. Keep premises in a clean and orderly condition during performance of all Work.

D. Place non-hazardous construction debris wastes in secure containers for local landfill disposal on a daily basis.

END OF SECTION

SECTION 03 01 00
MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repair of cracks in concrete.
B. Repair of spalled and damaged concrete.
C. Repair of internal concrete reinforcement.

1.02 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).
B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
C. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars 2022.
D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement 2019, with Editorial Revision (2020).
E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
F. ASTM C293/C293M - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading) 2016.
G. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
H. ASTM C496/C496M - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens 2017.
I. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.
J. ASTM C882/C882M - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear 2020.
K. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs 2022.
L. PS 1 - Structural Plywood 2019.

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.
B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.
C. Repair Procedures: Submit repair mortar manufacturer's narrative description of procedures and methods for removal of existing damaged concrete, repairing and cleaning of reinforcing steel, and applying new repair mortar and coatings.
D. Installer's qualification statement.
E. Statement of Application: Provide statement, signed by authorized representative of patching materials manufacturer, that manufacturer has reviewed contract documents and project

conditions relating to concrete repair and that manufacturer's materials proposed for use are suitable for the applications indicated.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with minimum of 5 years of documented successful in-service experience providing concrete repairs in similar size and complexity to that required for this project and approved by manufacturer. Experience in only installing or patching new concrete is insufficient experience for concrete-maintenance work.

B. Standards: Comply with provisions of the following Codes and Standards, except where more stringent requirements are shown or specified:
   1. ACI 318 - Building Code Requirements for Structural Concrete.
   2. Concrete Reinforcing Steel Institute (CRSI) - Manual of Standard Practice.

C. Testing: The Owner may engage a testing laboratory to perform material evaluation tests.
   1. Materials and installed work may require testing and re-testing at any time during progress of the work. Re-testing of rejected materials for installed work, shall be done at the Contractor's expense.
   2. See Section 01 40 00 - Quality Requirements for additional requirements.

1.05 MOCK-UPS

A. Crack Injection: Prepare one sample of each type of injection.

B. Horizontal Surface Repair: Total of approximately 1 foot square area, demonstrating each type of repair.

C. Vertical Surface Repair: Total of approximately 1 foot square area, demonstrating each type of repair.

D. Where color or texture matching is required, first prepare a small size sample on cementitious board.

E. Locate mock-up(s) where directed.

F. Re-work mock-up(s) until satisfactory to Architect/Engineer of Record.

G. Satisfactory mock-up(s) may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' instructions for storage, shelf life limitations, and handling of products.

PART 2 PRODUCTS

2.01 CEMENTITIOUS PATCHING AND REPAIR MATERIALS

A. Anti-corrosion coating: Solvent-free, moisture-tolerant product formulated as an anti-corrosion coating.
   1. Corrosion Inhibition: Material shall have been proven by independent laboratory testing to prevent corrosion of reinforcing steel when tested under procedures of the Federal Highway Administration Program Report FHWA/RD88/193.
   2. Product:
      a. DURALPREP A.C; Euclid Chemical.
      b. Sika Armatec 110 EpoCem; Sika Corp.
      c. Sto Epoxy Adhesive; Sto Concrete Restoration Division.

B. Cementitious Repair Material, Form and Pour/Pump Grade: Flowable, factory-mixed, polymer-modified cementitious material; in-place material resistant to freeze/thaw conditions.
   1. Bond Strength (by Slant Shear Test): 2200 psi at 28 days, per ASTM C882/C882M modified.
   2. Flexural Strength: 720 psi min at 28 days, per ASTM C293/C293M.
   3. Splitting Tensile Strength: 500 psi min. at 28 days, per ASTM C496/C496M.
   4. Compressive Strength: 5000 psi at 28 days, per ASTM C109/C109M.
   5. Product:
      a. MasterEmaco S 440CI; Master Builders Solutions.
      b. SikaTop 111 Plus; Sika Corp.
      c. SikaTop 211 SCC Plus; Sika Corp.
      d. Sto Full-Depth Plus; Sto Concrete Restoration Division
C. Cementitious Repair Material, Non-Sag, Trowel Grade: Factory-mixed, polymer-modified cementitious material; in-place material resistant to freeze/thaw conditions.
   1. Bond Strength (by Slant Shear Test): 1000 psi at 28 days, per ASTM C882/C882M.
   2. Flexural Strength:1000 psi min at 28 days, per ASTM C293/C293M.
   3. Splitting Tensile Strength: 400 psi min. at 28 days, per ASTM C496/C496M.
   4. Compressive Strength: 5000 psi at 28 days, per ASTM C109/C109M.
   5. Product:
      a. Civil/Structural VO; Dayton Superior
      b. MasterEmaco N400; Master Builders Solutions.
      c. SikaTop 123 Plus; Sika Corp.
      d. Sto Overhead Mortar; Sto Concrete Restoration Division.

2.02 EPOXY INJECTION MATERIALS

A. Pressure Injection Epoxy Adhesive: Non-sag, two-part, 100 percent solids; recommended by manufacturer for purpose and conditions under which used.
   1. Non-Load-Bearing Applications: ASTM C881/C881M Type I, II, III, IV, or V, whichever is appropriate to application.
   2. Load-Bearing Applications: ASTM C881/C881M Type IV or V, whichever is appropriate to application.
   3. Other Applications: ASTM C881/C881M Type as appropriate to application.
   4. Products:
      a. Epoxy Injection Resin:
         1) Sikadur 35 Hi-Mod LV Injection Resin; Sika Corporation
         2) CCS Grout Standard, ChemCo Systems
      b. Cap sealer for Ports and Cracks
         1) Dural 452 Gel; Euclid Chemical
         2) Sikadur 33; Sika Corporation
         3) Unitex Fast Pro-Poxy 300; Dayton Superior
B. Penetrating Crack Sealer: Non-sag, two-part, 100 percent solids; recommended by manufacturer for purpose and conditions under which used.
   1. Non-Load-Bearing Applications: ASTM C881/C881M, Type I, II, III, IV, or V, whichever is appropriate to application.

2. Load-Bearing Applications: ASTM C881/C881M, Type IV or V, whichever is appropriate to application.
3. Other Applications: ASTM C881/C881M, Type as appropriate to application.
4. Products:
    a. Dural 352 LV; Euclid Chemical
    b. Prime Rez 1200 Low Mod LV; Prime Resins, Inc.
    c. Sikadur 55SLV Healer/Sealer; Sika Corporation

2.03 ACCESSORIES

A. Form Materials for Exposed Concrete
    1. Plywood panel materials, to provide continuous, straight, smooth, exposed surfaces.
    2. Use plywood complying with U.S. Product Standard PS 1 "B B Plyform" (Concrete Form), Class I, Exterior Grade or better, mill oiled and edge sealed, with each piece bearing legible inspection trademark.
B. Water: Clean and potable.
C. Reinforcing Steel: ASTM A615/A615M Grade 60 (60,000 psi) billet-steel deformed bars, unfinished.
    1. Epoxy-coated Reinforcing Bars: ASTM A775/A775M.
D. Welded wire reinforcing (WWR): ASTM A1064/A1064M, 65,000 psi minimum yield strength.
    1. Epoxy-coated WWR: ASTM A884/A884M.
E. Supports for Reinforcement: Provide supports for replacement reinforcement as necessary including wire ties and spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place.
F. Adhesive Anchored Dowels:
    1. Dowels:
        a. ASTM A615/A615M, Grade 60, uncoated steel bars, cut true to length with ends square and free of burrs.
        b. ASTM F593, Group 2 (Type 304 or 316) stainless steel; 1/4 inch diameter, threaded rods.
    2. Adhesive:
        a. HIT-HY 200-R V3 Adhesive, Hilti, Inc.
        b. HIT-RE 500 V3 epoxy adhesive, Hilti, Inc.
        c. SET-XP High-Strength Epoxy Adhesive; Simpson Strong-Tie
        d. Sika AnchorFix-3001; Sika Corporation

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.
B. Beginning of installation means acceptance of substrate.

3.02 GENERAL

A. Mix repair materials in accordance with manufacturer's instructions. Mix multi-component products using equipment recommended by manufacturer. Only mix quantities which can be used within its pot life.
B. Coordinate the work required for the removal of the loose and delaminated concrete, including removal of sound material as needed to prepare the repair area, the repair and cleaning of the

exposed reinforcing steel, the placement of forms, and the placement of repair mortar to minimize the time that reinforcing steel is exposed.

3.03 CONCRETE SURFACE PREPARATION

A. Remove delaminated concrete and remove additional concrete as required to provide minimum required thickness of repair material and as required below.
B. Edge Preparation: Make a minimum 1/2" deep saw cut along perimeter of repair areas. Make cut at right angle to surface. Avoid feather edges. Geometric configurations or repair patches shall be kept as simple as possible.
C. After removals and edge conditioning are complete, remove bond inhibiting materials (dirt, concrete slurry, loosely bonded aggregates) by abrasive blasting or high pressure waterblasting with or without abrasive. Check the surfaces after cleaning to ensure that surface is free from additional loose aggregate, or that additional delaminations are not present.
D. If hydro demolition is used, cement and particulate slurry must be removed from the prepared surfaces before slurry hardens.

3.04 EXPOSING AND UNDERCUTTING REINFORCING STEEL

A. Remove damaged or unsound concrete. Use concrete removal procedures which will not structurally weaken the surrounding existing concrete.
B. Once initial concrete removal is made, undercut exposed oxidized (corroded) reinforcing. Undercutting shall provide clearance for cleaning, full bar circumference bonding to surrounding concrete, and securing the patch structurally.
C. Provide minimum 3/4" clearance between exposed rebars and surrounding concrete or 1/4" larger than largest aggregate in repair mortar, whichever is greater.
D. Concrete removals shall extend along the bars to locations along the bar free of bond inhibiting corrosion, and where the bar is well bonded to surrounding concrete.
E. If unoxidized reinforcing steel is exposed during the undercutting process, care shall be taken not to damage the bar's bond to surrounding concrete. If bond between bar and concrete is broken, undercutting of the bar shall be required. Any bar portion that has more than one-third of its circumference exposed shall be fully exposed around its circumference by concrete removal.
F. Any reinforcement which is loose shall be secured in place by tying to other secured bars or by other approved methods.
G. Condition edges of repair area by making 1/2 in. saw cut along perimeter.

3.05 REPAIRING AND CLEANING OF REINFORCING STEEL

A. After removal of concrete, notify Architect/Engineer of Record for inspection of steel reinforcing.
B. If a reinforcing bar has lost more than 20% of its cross section, provide one of the following repair methods:
    1. Completely replace reinforcing, or
    2. Add supplemental reinforcing over the affected section. The new reinforcing bar may be mechanically spliced to the existing bar or placed parallel to and approximately 3/4" from the existing bar. Lap length shall be in accordance with ACI 318.
C. Remove heavy oxides and scale from the exposed reinforcing bars, as necessary to insure maximum bond of the replacement material.

D. Apply two coats of anti-corrosion material to reinforcing bars and other embedded steel exposed in the repair area.

3.06 INSTALLING REPAIR MATERIALS

A. General: Perform repairs using flowable mortar or non-sag mortar as appropriate to conditions at each location.

B. Forms:
   1. Support, brace, and maintain forms as required to support loads that might be applied. Construct formwork so concrete repair patch is of correct size, shape, and alignment.
   2. Construct forms of one piece and to obtain accurate alignment, location, grades, and plumb work in finished repair.
   3. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
   4. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive repair mortar. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Tighten forms and bracing before repair mortar placement to prevent mortar leaks and maintain alignment.

C. Preparation of Form Surfaces:
   1. Coat contact surfaces of forms with a non-residual, form-coating compound.
   2. Do not allow excess form-coating material to accumulate on forms or to come into contact with existing concrete surfaces against which repair mortar will be placed. Apply in compliance with manufacturer's instructions.
   3. Where coatings or stains are to be used, confirm compatibility of form-coating compound with coating/stain manufacturer prior to application.

D. Repair Mortar Placement:
   1. Deposit repair mortar continuously in a manner to avoid segregation at its final location and in accordance with manufacturer's instructions.

E. Finish of Formed Surfaces: Provide an as-cast concrete surface to match the existing cast in place concrete surface, with a minimum of seams. Repair and patch defective areas including fins and other projections completely removed and smoothed. Match approved field sample.

F. Curing and Protection: Protect freshly placed repair mortar from premature drying and excessive cold or hot temperatures.

3.07 CRACK REPAIR USING PENETRATING CRACK SEALER

A. NOTE: Adjust the following to suit project conditions.

B. Prepare exposed cracks. Cracks shall be clean, sound, and free of surface water (may be damp but not wet). Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means. Blow cracks clean with oil free compressed air.

C. Follow epoxy adhesive manufacturer's written installation instructions.

D. Clean surfaces adjacent to repair and blend finish.

3.08 CRACK REPAIR USING EPOXY ADHESIVE INJECTION

A. Prepare exposed cracks. Cracks and surface 1" on each side of crack shall be clean, sound, and free of surface water (may be damp but not wet). Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means. Blow cracks clean with oil free compressed air.
B. Follow epoxy adhesive manufacturer's written installation instructions.
C. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than the depth of the crack to be filled and port size diameter no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.
D. Inject adhesive into ports under pressure using equipment appropriate for particular application.
E. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.
F. Remove temporary seal and excess adhesive.
G. Clean surfaces adjacent to repair and blend finish.

END OF SECTION 03 01 00

SECTION 03 30 53
MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, and other concrete elements indicated.

1.02 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 301 - Specifications for Structural Concrete; 2016.

C. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

E. ACI 305R - Guide to Hot Weather Concreting; 2010.

F. ACI 306R - Guide to Cold Weather Concreting; 2016.

G. ACI 308R - Guide to External Curing of Concrete; 2016.

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).

I. ACI 347R - Guide to Formwork for Concrete; 2014.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

K. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2017a.

N. ASTM C150/C150M - Standard Specification for Portland Cement; 2017.

O. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

P. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

Q. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.

R. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).

S. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004, with Editorial Revision (2013).

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design a minimum of 15 days prior to start of work in this section.
1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
2. Do not begin concrete production until Mix Design has been approved.

1.04 QUALITY ASSURANCE

A. Testing Agency: The Owner may engage an independent testing agency to perform initial quality control testing.
1. Allow access by Owner's testing agency to material stockpiles and facilities at all times.
2. Materials and installed work may require testing and retesting at any time during the progress of the work.
3. Retesting of rejected materials and installed work shall be done at the Contractor's expense.

B. Source Limitations: Obtain each type or class of cementitious materials of the same brand from the same manufacturer's plan, each aggregate from one source, and each admixture from the same manufacturer.

C. Perform work of this section in accordance with ACI 301 and ACI 318.

D. Follow recommendations of ACI 305R when concreting during hot weather.

E. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 - PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand project conditions without distortion in excess of permitted tolerances.
1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes. Construct paper of fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist plastic concrete loads imposed by concrete without deformation.

D. Form Ties: Removable or snap-off type, galvanized metal or plastic, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

E. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
1. Provide form-release agent with rust inhibitor for steel form-facing materials.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
1. Type: Deformed billet-steel bars.
2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.

C. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.
1. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.

D. Water: Potable: ASTM C94/C94M

E. Use of Calcium Chloride in concrete is not permitted.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

D. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer plastic extrusion manufactured with polyolefin resins.
   1. Maintain permeance of less than 0.01 Perms as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
   2. Strength: ASTM E1745 Class A.
   3. Thickness: 15 mils minimum
   4. Manufacturers
      a. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., www.stegoindustries.com. Or equivalent product by:
         1) Griffolyn 65 by Reef Industries, www.reefindustries.com.
         2) Moistop Ultra15 by Fortifiber Building Systems Group. www.fortifiber.com.

B. Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D1751, cellulose fiber.

C. Curing Compound, Non-dissipating: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309, Type 1, Class B.

D. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.
   2. Polyethylene film, clear, minimum nominal thickness of 0.0040 inch.
   3. White-burlap-polyethylene sheet, weighing not less than 10 ounces per linear yard, 40 inches wide.

E. Fill: Well graded, clean, crushed stone or gravel; State of Illinois, Department of Transportation, Gradation: CA6

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Self-Expanding Strip Waterstops: Bentonite or other hydrophilic material, complying with NSF 61 and NSF 372.
   1. Configuration: Rectangular or trapezoidal strip.
   2. Size: As indicated on drawings; in longest lengths practicable.
   3. Manufacturers:
      a. Volclay Waterstop-RX; Colloid Environmental Technologies Co..
      b. Conseal CS-231; Concrete Sealants Inc..
      c. Swellseal Joint; De Neef Construction Chemicals (U.S.) Inc.
      d. Hydrotite; Greenstreak
      e. Mirastop;Mirafi Moisture Protection, Div. of Royal Ten Cate (U.S.), Inc
      f. Adeka Ultra Seal; Mitsubishi International Corporation
      g. Superstop; Progress Unlimited Inc.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D1752 cork or self-expanding cork (Type III).

2.07 CONCRETE MIX DESIGN

A. Ready-Mixed Concrete: Comply with ASTM C94/C94M.
   1. Compressive Strength: 3,000 psi

B. Air Entrainment: Provide mix with air-entrainment for all exterior horizontal concrete surfaces subject to weather and moisture.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete for Footings and Foundation Walls, and Interior Slab-on-Grade:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch, unless noted otherwise
   2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.
   3. Water-Cement Ratio: Maximum 44 percent by weight.
   4. Total Air Content: For exterior exposed concrete: 6 percent (plus 1 or minus 1.5 percent), determined in accordance with ASTM C173/C173M. Do not air entrain trowel finished interior floors.
   5. Maximum Slump: 4 inches.

E. Normal Weight Concrete for Exterior Slab-on-Grade:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 5,000 pounds per square inch, unless noted otherwise
   2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight. For concrete exposed to deicers, limit percentage by weight of cementitious materials other than Portland cement according to ACI 301.
   3. Water-Cement Ratio: Maximum 40 percent by weight.
   4. Total Air Content: 6 percent, determined in accordance with ASTM C173/C173M.
   5. Maximum Slump: 4 inches.

2.08 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
   1. Colored Concrete: Add pigments in strict accordance with manufacturer's instructions to achieve consistent color from batch to batch.
   2. Fiber Reinforcement: Batch and mix as recommended by manufacturer for specific project conditions.

B. Transit Mixers: Comply with ASTM C94/C94M, and ASTM C1116/C1116M and furnish batch ticket information.
   1. When air temperature is between 85 an 90 deg F, reduce mixing and delivery time from 90 minutes to 75 minutes; when aire temperature is above 90 def F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION - SLAB ON GRADE PATCHING

A. Align saw-cuts in a pattern acceptable to Architect/Engineer of Record.

B. Fill to underside of existing slab with specified fill material over properly placed and compacted backfill (if required). Place in 4" layers and thoroughly hand compact to provide firm substrate upon which to place slabs.

C. Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
   1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on the drawings. Do not use sand.

D. Apply concrete bonding agent to cut slab edge immediately before placing concrete.

3.03 PREPARATION - GENERAL

A. Formwork: Comply with requirements of ACI 347R. Fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in accordance to bonding agent manufacturer's instructions.
   1. Use latex bonding agent only for non-load-bearing applications.

D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.04 ERECTION OF FORMWORK

A. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

B. Install sufficient lengths of forms to allow continuous progress of the work and so that forms can remain in place at least 24 hours after concrete placement.

C. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

E. Apply form release agent on formwork in accordance with manufacturer's recommendations.
   1. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 FORMS FOR EXPOSED CONCRETE:

A. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.

B. Do not use metal cover plates for patching holes or defects in forms.

C. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.

D. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce a bow.

E. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.

F. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

3.06 INSTALLING REINFORCEMENT

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths and offset end laps in both directions. Splice laps with tie wire.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement.

3.07 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken

D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.08 FORM REMOVAL

A. Formwork may be removed 48 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.09 SLAB JOINTING

A. Anchor joint fillers and devices to prevent movement during concrete placement.

B. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

C. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect/Engineer of Record.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
   2. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   3. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   4. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   6. Space vertical joints in walls at not more than 60 feet in any horizontal direction. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 24 after placing; use 1/8 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
   1. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into 15-foot maximum perpendicular strips, and areas not exceeding 225 square feet.

3.10 CONCRETE TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Formed concrete having any dimension smaller or greater than required, and outside the specified tolerance limits, will be considered deficient in strength and subject to additional testing.

D. Formed concrete having any dimension greater than required will be rejected if the appearance or function of the structure is adversely affected, or if the larger dimensions interfere with other construction. Repair or replace rejected concrete as required to meet the construction conditions. When permitted, accomplish the removal of excessive material in a manner to maintain the strength of the section without affecting function and appearance.

3.11 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unformed Surfaces: After striking off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
   1. After floating, test surfaces for trueness with a 10' straight-edge. Distribute concrete as required to remove surface irregularities, and refloat repair areas to provide a continuous, smooth finish.
   2. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing by two steel trowlings until all marks are eliminated and ringing sound as produced by the trowel is moved over the surface.

C. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

D. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

E. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
   2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

3.12 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete, but not less than 7 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
   2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than seven days by water ponding, water-fog spray, or saturated burlap.
      a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.
      b. Spraying: Spray water over floor slab areas and maintain wet.
      c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides at least 12 inches; maintain in place.
   3. Final Curing: Begin after initial curing but before surface is dry.
      a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

E. Repair of Formed Surfaces:
1. Repair exposed-to-view formed concrete surfaces, where possible, that contain defects which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Architect/Engineer of Record. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
2. Repair concealed formed concrete surfaces, where possible, that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01" wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls, except minor breakage at corner.
3. Repair and patch defective areas with cement mortar immediately after removal of forms, but only when acceptable by the Architect/Engineer of Record.
4. Cut out honeycomb, rock pockets, voids over 1/2" diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with neat cement grout.

3.13 FIELD QUALITY CONTROL

A. Initial Testing: The Owner may engage an independent testing agency to perform field quality control tests, if required, and as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

D. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect/Engineer of Record. The Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

E. Defective Work: Concrete work which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor’s expense without extension of time. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

F. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof.
a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

G. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

H. Air Content: ASTM C173/C173M for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

I. Concrete Temperature: ASTM A1064/A1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

J. Unit Weight: ASTM C567/C567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

K. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.

L. Compressive-Strength Tests: ASTM C39/C39M
   1. Test two specimens at 7 days, two at 28 days and one at 56 days if 28-day compressive strength has not yet been obtained.
   2. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

M. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

N. Test results shall be reported in writing to Architect/Engineer of Record, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

O. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect/Engineer of Record but will not be used as sole basis for approval or rejection of concrete.

P. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect/Engineer of Record. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect/Engineer of Record.

3.14 PROTECTION

A. Protect concrete from damage until acceptance of work.

B. Do not permit traffic over unprotected concrete floor surface until fully cured (minimum 14 days).

C. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

END OF SECTION 03 30 53

SECTION 03 54 00

CAST UNDERLAYMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.
   1. Use cementitious type at locations indicated, including:
      a. Existing concrete floors exposed by remodeling
      b. Leveling of floor finish substrates.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2017.

C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

E. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, mixing instructions, environmental limitations, storage and handling requirements, and installation instructions.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.06 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.

C. Close areas to traffic during underlayment application and for time period after application recommended by manufacturer.

D. During the curing process, ventilate spaces to remove excess moisture.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Cementitious Underlayment:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. BASF; MasterTop 110SL: www.master-builders-solutions.basf.us
3. Dayton Superior Corporation; LeveLayer with Level Primer J42: www.daytonsuperior.com.
4. Maxxon Corporation; Level-Right: www.maxxon.com

2.02 MATERIALS

A. Cementitious Underlayment: Blended cement-based, polymer-modified mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
1. Cement: Portland cement per ASTM C150/C150M; or hydraulic or blended hydraulic cement per ASTM C219.
2. Compressive Strength: Minimum 4000 pounds per square inch after 28 days, tested per ASTM C109/C109M.
3. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
4. Density: 125 pounds per cubic foot, nominal.
5. Final Set Time: 1-1/2 to 2 hours, maximum.
6. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
7. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

B. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.

C. Reinforcement: Galvanized metal lath complying with recommendations of underlayment manufacturer for specific project circumstances.

D. Water: Potable and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 1/2 inch. Mix underlayment and water for at least two minutes before adding aggregate and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

A. Concrete: Prepare surfaces according to ICRI 310.2R-2013; “Technical Guideline for Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair”.

B. Wood: Install metal lath for reinforcement of underlayment.

C. Non-porous Substrates: remove waxes, sealants, and other contaminants that might impair underlayment bond according to manufacturer’s written recommendations.

D. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

E. Vacuum clean surfaces. Provide clean, dry, neutral-pH substrate for underlayment application.

F. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

G. Close floor openings.

H. Treat nonmoving substrate cracks to prevent cracks from telegraphing through underlayment according to manufacturer’s written recommendations.

I. After substrate preparation, test substrate for adhesion with underlayment according to manufacturer’s written instructions.

3.03 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.

C. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

D. Apply primer or prepared substrate at manufacturer’s recommended spreading rate.

E. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft. Feather edges to match adjacent floor elevations.

F. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

3.04 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

C. Do not install finish flooring over underlayment until after time period recommended by underlayment manufacturer.

3.05 FIELD QUALITY CONTROL

A. Remove and replace underlayment areas the evidence lack of bond with substrate, including areas that emit a “hollow” sound when tapped.

3.06 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

C. Protect from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 00

SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water and Chemical cleaning of Brick, Structural Glazed Tile and Stone surfaces.
B. Replacement of Brick, Stone, and Structural Glazed Tile units.
C. Repointing mortar joints.
D. Repair of damaged masonry.

1.02 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
B. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
C. High-Pressure Spray: 800 to 1200 psi; 4 to 6 gpm.

1.03 REFERENCE STANDARDS

A. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023a.
C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
D. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials 2017, with Editorial Revision (2021).
E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
F. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2022b.
G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
H. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2022.
I. ASTM B32 - Standard Specification for Solder Metal 2020.
J. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units 2022.
K. ASTM C1261 - Standard Specification for Firebox Brick for Residential Fireplaces 2013.
L. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
N. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
O. ASTM C27 - Standard Classification of Fireclay and High-Alumina Refractory Brick 1998 (Reapproved 2022).
P. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
Q. ASTM C315 - Standard Specification for Clay Flue Liners and Chimney Pots 2007 (Reapproved 2021).
R. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
S. ASTM C476 - Standard Specification for Grout for Masonry 2023.

T. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale) 2017.
U. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
V. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) 2022.
W. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2017.
X. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2023.
Y. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
      a. Require attendance of parties directly affecting work of this section.
         1) Contractor's Superintendent
         2) Installer
         3) Manufacturer/Fabricator Representative
         4) Other affected Subcontractors
         5) Architect/Engineer of Record
         6) Owner’s Representative
   3. Review mock-ups as described in Mock-Up article below.
   4. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, Owner and those affected by decisions made.

1.05 SUBMITTALS

A. See Book 2 for submittal procedures.
B. Product Data: Provide data on each cleaning product, mortar product, and masonry product. Include application instructions, where applicable. Demonstrate that products comply with specified requirements..
C. Submit mix design for each type of mortar and grout.
D. Samples - Masonry: Submit three samples of each type of exposed masonry unit units to illustrate matching color, texture and extremes of color range. Provide two week review period for sample submittals.
   1. For each brick type provide one straps or panels of at least four bricks. Include photographs of proposed brick straps / panels in context of cleaned brick mock-up illustrating each comfort station matrix for architect’s review.
   2. For each type of stone provide minimum 6 inch square samples. Include photographs of proposed new material in context of each comfort station’s cleaned stone for architect’s review.
E. Samples - Mortar: Submit samples of mortar for each type of masonry, showing the range of color which can be expected in the finished work.
F. Masonry Contractor's qualification statement.

1.06 QUALITY ASSURANCE - MASONRY WORK

A. Obtain each type of masonry restoration product from a single source, and in sufficient quantities to ensure consistency in quality, appearance, and physical properties.

B. Masonry Contractor Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience. Engage an experienced masonry restoration firm to perform work of this Section. Demonstrate that firm has completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

1. Apprentices must be fully supervised by an experienced tradesman.
2. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that masonry restoration and cleaning are in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.

1.07 MOCK-UPS

A. Prepare mock-ups of masonry restoration and cleaning as follows to demonstrate aesthetic effects and qualities of materials and execution. Prepare mockups on existing walls under same weather conditions to be expected during remainder of the work. Obtain written approval of the mock-up to serve as a sample for subsequent work prior to the commencement of work:

1. Masonry rebuilding: Minimum 3 feet high and 4 feet wide for each type of masonry material indicated to be rebuilt or replaced.
2. Masonry patching: 3 separate areas, minimum of 1 inch diameter each, for each type of masonry material indicated to be patched.
3. Joint grinding: Minimum 3 feet high and 4 feet wide.
4. Joint pointing: Minimum 3 feet high and 4 feet wide, adjacent to and separate from joint grinding mock-up. Joint profile to match existing joint profile unless otherwise directed by Architect/Engineer of Record.
5. Cleaning: Implement a pre-cleaning testing program. Conduct a site meeting in accordance with the Preinstallation meeting article above. Review the following:
    a. Select areas representing each differing condition and type of masonry unit to be cleaned.
    b. Conduct tests, approximately 2 feet high by 2 feet wide, utilizing proposed cleaning products and application methods recommended by the product representative starting with the gentlest product and method of application and progressing to the level acceptable to the Architect/Engineer of Record for each material and condition.
    c. Record the materials and methods utilized for each selected area.
    d. Develop a cleaning program and sequence of work that complies with the requirements of authorities having jurisdiction including the State of Illinois and City of Chicago and that will protect each masonry material form damage by cleaning of other materials.

B. Acceptable mock-up panels and procedures employed to achieve them will become the standard for work of this section.

C. Mock-ups may remain as part of the work. Maintain temporary demarcation of mock-up panels throughout completion of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.
B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
E. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.09 FIELD CONDITIONS - MASONRY WORK

A. Cold and Hot Weather Requirements:
   1. Repointing Mortar Joints: conduct work only when air temperature is between 40 degrees F and 90 degrees F and is predicted to remain so for at least 7 days after completion of work. Do not apply mortar to substrates with temperatures of 90 degrees F and above.
   2. Masonry Rebuilding: conduct work only when air temperature is between 40 degrees F and 90 degrees F and is predicted to remain so for at least 7 days after completion of work. Do not apply mortar to substrates with temperatures of 90 degrees F and above.
   3. Masonry Patching: conduct work only when air and surface temperatures are between 55 degrees F and 100 degrees F and are predicted to remain above 55 degrees F for at least 7 days after completion of work. On days when air temperature is predicted to go above 90 degrees F, schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.
   4. Masonry Cleaning: conduct work only when air temperatures are above 40 degrees F and predicted to remain so for at least 7 days after completion of cleaning.
   5. Protect masonry repairs, patching, and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required.

1.10 SEQUENCING AND SCHEDULING

A. Perform masonry restoration work in the following sequence:
   1. Remove plant growth.
   2. Remove paint.
   3. Clean masonry surfaces removing all paint, efflorescence, loose mortar, etc.
   4. Rake out joints that are to be repointed on masonry, clean and remove all loose material from concrete cracks to be repaired.
   5. Repair existing masonry and concrete. Replace existing masonry with new masonry materials as required.
   6. Point mortar joints.

Coordinate concrete restoration and window replacement work with sequence above to ensure that new and existing windows will not be damaged by cleaning process.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Provide products specified and as established by the results of the pre-cleaning testing program and mock-ups in this section.

2.02 CLEANING MATERIALS - PAINT REMOVAL

A. Alkaline Paste Paint Remover: Alkaline paste formulation for removing paint coatings from masonry.
   1. American Building Restoration Products, Inc.; 800 Brush Grade.
   2. Diedrich Technologies Inc.; 606/606X Extra Thick Multi-Layer Paint Remover.
   3. Hydrochemical Techniques, Inc.; Hydroclean Heavy Duty Paint Remover (HT-716).
   4. Price Research, Ltd.; Price Heavy Duty Paint Stripper.
   5. PROSOCO; Sure Klean Heavy-Duty Paint Stripper.

B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.
   1. American Building Restoration Products, Inc.; Grip 'N Strip 800 F.A.
   2. Diedrich Technologies Inc.; 404 Rip-Strip.
   3. Dumond Chemicals, Inc.; Peel Away 1 System.
   4. PROSOCO; Enviro Klean SafStrip

C. Solvent-Type Paint Remover: Water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
   1. American Building Restoration Products, Inc.; No. 3 Grip 'N Strip.
   2. Diedrich Technologies Inc.; 505 Special Coatings Stripper.
   3. Dominion Restoration, Inc.; Dominion Multi-Layer Paint & Graffiti Remover.
   4. Dumond Chemicals, Inc.; Peel Away 2.
   5. Hydrochemical Techniques, Inc.; Hydroclean Solvent Paint Remover (HT-300).
   6. Price Research, Ltd.; Price Strip-All.
   7. PROSOCO; Sure Klean Graffiti Remover or Enviro Klean SafStrip.

D. Low-Odor, Solvent-Type Paint Remover: Low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.
   1. American Building Restoration Products, Inc.; 800 No Lye Grip 'N Strip, Super Bio Strip Gel or Super Bio Strip Paste as established by the pre-cleaning testing program..
   2. Dumond Chemicals, Inc.; Peel Away 6.
   3. PROSOCO; Enviro Klean SafStrip 8 or SafStrip 8.

2.03 CLEANING MATERIALS - MASONRY

A. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gallons. of solution required.

B. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups of tetrasodium polyphosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gallons of solution required.

C. pH neutral Mold, Mildew and Algae Remover
   1. PROSOCO; Enviro Klean ReVive

D. Nonacidic Gel Cleaner: Gel formulation, with pH between 6 and 9, that contains detergents and chelating agents and is specifically formulated for cleaning masonry surfaces.
   1. Price Research, Ltd.; Price Marble Cleaner-Gel.

2. PROSOCO; Sure Klean 942 Limestone & Cleaner or Enviro Klean EK Restoration Cleaner.

E. Nonacidic Liquid Cleaner: Mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
1. Dominion Restoration, Inc.; Bio-Cleanse.
2. Dumond Chemicals, Inc.; Safe n' Easy Architectural Cleaner/Restorer.
3. Price Research, Ltd.; Price Non-Acid Masonry Cleaner.
4. PROSOCO; Enviro Klean Restoration Cleaner or Enviro Klean 2010 All Surface Cleaner.

F. Mild Acidic Cleaner: Mildly acidic cleaner containing no hydrochloric, hydrofluoric, or sulfuric acid; or chlorine bleaches.
1. Diedrich Technologies Inc.; Envirorestore 100.
2. Dominion Restoration, Inc.; DR-60 Stone and Masonry Cleaner.
3. Dumond Chemicals, Inc.; Safe n' Easy Heavy Duty Restoration Cleaner.
4. PROSOCO; Sure Klean Light-Duty Restoration Cleaner or Enviro Klean SafRestorer.

G. Acidic Cleaner: Acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids, detergents, wetting agents, and inhibitors.
1. American Building Restoration Products, Inc.; 801 Heavy Duty Masonry Cleaner.
2. Diedrich Technologies Inc.; 101 Masonry Restorer or 101G Granite, Terra Cotta, and Brick Cleaner.
3. Hydrochemical Techniques, Inc.; Hydroclean Brick, Granite, Sandstone and Terra Cotta Cleaner (HT-626).
4. Price Research, Ltd.; Price Heavy Duty Restoration Cleaner or Price Restoration Cleaner.
5. PROSOCO; Sure Klean Heavy-Duty Restoration Cleaner or Sure Klean SafRestorer.

H. Two-Part Chemical Cleaner: Multi-part formulation consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
1. PROSOCO; Sure Klean 766 Limestone & Masonry Prewash and Afterwash.

I. One-Part Limestone Cleaner: Single-part acidic formulation for cleaning limestone.
1. American Building Restoration Products, Inc.; X-190 Limestone & Concrete Cleaner.
2. Hydrochemical Techniques, Inc.; Hydroclean Limestone and Marble Cleaner and Brightener (HT-907).
3. Price Research, Ltd.; Price Limestone Restorer.
4. PROSOCO; Sure Klean Limestone Restorer.

J. Two-Part Limestone Cleaner: Multi-part formulation consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
1. American Building Restoration Products, Inc.; 500 Limestone Prewash Cleaner and 500 Limestone Afterwash.
2. Diedrich Technologies Inc.; Diedrich Limestone Cleaner Prerinse (707) and Neutralizer After-Rinse (707N).
3. Hydrochemical Techniques, Inc.; Hydroclean Limestone and Marble Precleaner (HT-704) and Hydroclean Limestone and Marble Cleaner and Brightener (HT-907).
4. Price Research, Ltd.; Price Limestone Pre-Wash/Limestone After-Wash System.
5. PROSOCO; Sure Klean 766 Limestone & Masonry Prewash and Afterwash.

K. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
   1. American Building Restoration Products, Inc.; LM 130 Acid Shield.
   2. Diedrich Technologies Inc.; Diedrich Acid Guard.
   3. Price Research, Ltd.; Price Mask.
   4. PROSOCO; Sure Klean Strippable Masking.

2.04 EFFLORESCENCE REMOVAL (concrete soffits)

A. PROSOCO; Sure Klean Light Duty Concrete Cleaner
B. Other manufacturer’s products will be considered subject to compliance with project requirements.

2.05 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C114 where required to achieve required mortar color..
B. Masonry Cement: Not Acceptable
C. Hydrated Lime: ASTM C207, Type S.
D. Mortar Aggregate: ASTM C144.
   1. For joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.
   2. Provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
   3. For pointing mortar, provide sand with rounded edges.
   4. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, if necessary, to achieve suitable match.
E. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.
F. Grout Aggregate: ASTM C404.
G. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect/Engineer of Record from manufacturer's full range.
   2. Manufacturers:
      a. Bayer Corporation, Industrial Chemicals Div.: Bay ferrox Iron Oxide Pigments
      b. Davis Colors: www.daviscolors.com.
      c. Solomon Colors: www.solomoncolors.com/sle.
H. Water: Clean and potable.

2.06 MASONRY MATERIALS

A. Facing Brick: ASTM C216, Unless matching of existing dictates otherwise: Type FBX, Grade SW.
   1. Color and texture: Match Existing – submit on-site photographs of proposed match in context for review and approval for each facility requiring brick replacement or new brick to match.

a. For existing brickwork that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.
2. Nominal size: Match Existing.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
4. Compressive strength: Minimum of 3350 psi, measured in accordance with ASTM C67.

B. Building (Common) Brick: ASTM C62, Grade SW.
C. Concrete Masonry Units: ASTM C90.
D. Ceramic Glazed Face Brick: ASTM C126, Grade SS (Select Sized), Type I (single-faced units).
E. Fireclay Refractory Brick: ASTM C27 Class Super-duty; actual size to match existing.
F. Ceramic Glazed Structural Clay Facing Tile: ASTM C126; Grade S (Select); Types I and II, as indicated on drawings for various locations.
G. Stone: Provide new stone in like kind, color, and finish.
H. Firebox Brick: ASTM C1261, size required to produce lining thickness indicated.
I. Clay Flue Liner: ASTM C315, shape to match existing.

2.07 PATCHING AND REPAIR MATERIALS

A. Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry, is vapor- and water permeable, exhibits low shrinkage, and develops high bond strength to all types of masonry.
1. Formulate patching compound used for patching masonry materials shown in colors and textures to match unit being patched.
2. Cathedral Stone Products, Inc.; Jahn Restoration Mortar.
3. Edison Coatings, Inc.; Custom System 45.
4. Conproco: Matrix Repair Mortar

B. Stone-to-Stone Adhesive: 2-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 degrees F or 1-part cementitious stone adhesive, recommended by adhesive manufacturer for type of stone repair indicated, and matching stone color.
1. Two-Part Polyester or Epoxy:
a. Akemi North America; Akepox.
b. Bonstone Materials, Inc.; A-199-T/B-439-T.
c. Edison Coatings, Inc.; Flexi-Weld 520T.
2. One-Part Cementitious Stone Adhesive:
a. Cathedral Stone Products, Inc.; Jahn Restoration Adhesive.

C. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone, is vapor- and water permeable, exhibits low shrinkage, and develops high bond strength to all types of stone. Formulate in colors and textures to match stone being patched. Provide number of colors needed to enable matching each piece of stone.
1. Cathedral Stone Products, Inc.; Jahn Restoration Mortar.
2. Edison Coatings, Inc.; Custom System 45.
3. Conproco; Matrix Repair Mortar

D. Cementitious Crack Filler: An ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
1. Cathedral Stone Products, Inc.; Jahn Injection Grout.
2. Edison Coatings, Inc.; Pump-X 53i.
3. Conproco; Injection Grout

E. Stone Consolidation Treatment: Ready-to-use product designed for consolidation of masonry materials that have deteriorated due to weathering and exposure to pollutants. Treatment shall be composed of silicic-ethyl esters, a neutral catalyst, and solvents.
   1. PROSOCO; Conservare OH100 Stone Strengthener.

F. Stone Consolidation and Water-Repellent Treatment: Ready-to-use product designed for consolidation and water-repellent treatment of masonry materials that have deteriorated due to weathering and exposure to pollutants. Treatment shall be composed of silicic-ethyl esters, a neutral catalyst, a silane water repellent, and solvents.
   1. Edison Coatings, Inc.: System 90-II.
   2. PROSOCO; Conservare H100 Stone Strengthener.

2.08 REINFORCEMENT AND ANCHORAGE

A. Masonry joint reinforcing: ASTM A951/A951M and as follows;
   1. Exterior Walls: Hot-dip galvanized, carbon steel.
   2. Wire Size for Side Rods: W1.7 or 0.148-inch.
   3. Wire Size for Cross Rods: W1.7 or 0.148-inch.
   4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   5. Provide in lengths of not less than 10 feet
   6. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
   7. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Provide where bed joints do not line up.

B. Wall Ties: Corrugated formed sheet metal, 7/8 inch wide by 0.097 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

C. Stone Anchors: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and dowels from Type 304 stainless steel.

D. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4 inch diameter, Type 304 stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.
   1. Basis of Design: Hohmann & Barnard, Inc. Torq-Lok 520 Series Anchor.

E. Masonry Repair Anchors, Spiral Type: Type 304 stainless-steel spiral rods designed to anchor to backing and veneer. Anchors are flexible in plane of veneer but rigid perpendicular to it.
   1. Provide one of the following:
      a. Adhesive-installed anchors complete with manufacturer's standard epoxy adhesive and injection tubes, screens, sleeves, or other devices required for installation.
      b. Provide driven-in anchors designed to be installed in drilled holes and relying on screw effect rather than adhesive to secure them to backup and veneer.
         1) Blok-Lok, ltd; Torq-Lok anchors.
         2) Hohmann & Barnard, Inc: Spira-Lok.
         3) Heckmann Building Products, Inc.; #391 Spiro Remedial Tie.
         4) Helifix Ltd.; Helifix HRT60 or Helifix HRT80.

5) PROSOCO; Stitch Tie helical ties

F. Metal Primer: Zinc-rich Primer; SSPC Paint 20 or 29.

2.09 FLASHINGS

A. Flexible flashing:
1. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to compliance with specified requirements. Select products that are compatible with air barrier system, refer to Section 07 27 00 - Air Barriers.
2. Self-adhering membrane flashing, thickness – 40 mil, minimum. Compatible with selected air barrier system and capable of meeting NFPA 285 assembly requirements.
a. Carlisle Coatings and Waterproofing, Inc; CCW-705.
b. GCP Applied Technologies; Perm-A-Barrier.
c. Henry Company; Blueskin TWF.
d. Tremco Commercial Sealants & Waterproofing; ExoAir TWF.
3. Self-adhering stainless steel flashing
a. Basis of Design: York Manufacturing, Inc.; York 304 SA SS
b. Other products that meet the specified criteria:
1) Type: stainless steel core with one uncoated (bare) stainless steel face (outward facing) with a butyl block co-polymer adhesive (inward facing).
2) Stainless steel: type 304, ASTM A240/A240M. Domestically sourced per DFARS 252.225-7008 and/or DFARS 252.225-7009.
4. Adhesive: block co-polymer
a. Size: Manufacturer's standard width rolls.
b. No primer required.
c. UV resistant.
d. 20-year warranty.
e. Fire resistant: ASTM E84 Class A material.
f. Mold resistant: complies with ASTM D3273.
g. Complies with ICC-ES AC148.
h. Complies with air barrier material test: ASTM E2178.

B. Corner and End Dams: Form the Stainless steel flashing or use 26 gauge stainless steel pre-manufactured corners.

C. Flashing Sealant/Adhesives and Lap Splice Tape/Seal: Sealant capable of adhering to type of flashing material used including low-energy, cross-laminated polyethylene backing used with self-adhering membranes
1. Dow; Dowsil 758 Silicone Weather Barrier Sealant...
2. York Manufacturing, Inc; UniverSeal US-100 Liquid Tape and York 304 SA for use with York flashings: www.yorkmfg.com
3. York Manufacturing, Inc.; York 304 SA
4. GE Silicones, Inc.; GE Elemax SS Flashing
5. VaproShield, Inc.; Vapro Thru-Wall Flashing SA

D. Termination Bars: Aluminum or 300 series Stainless steel rigid; compatible with membrane and adhesives.
1. Manufacturers:
a. York Manufacturing, Inc; Termination Bar, SS: www.yorkmfg.com

E. Metal Flashing:

1. Stainless-Steel Sheet: (all locations unless otherwise noted herein or on Drawings): ASTM A240/A240M, Type 304; No. 2D mill rolled finish; 28 gauge.
    a. Solder: ASTM B32, composition 50 percent tin and 50 percent lead.
    b. Flux: Special stainless steel type flux. Neutralize flux after soldering.
2. Pan Flashing: Stainless steel pan with integral angled drip with hemmed edge; compatible with membrane and adhesives
    a. Dimensions:
        1) Horizontal leg to be full depth of cavity. Provide 1 inch miter along inside corner to accept self-adhering membrane flashing and reduce tenting and angled hemmed drip edge.
        2) Vertical leg to be 2 inch tall. Provide hemmed edge.
    b. End dams: Integral with pan. Fully soldered.

F. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
1. Dimension: minimum 3 inches wide by 0.015 inch thick.

2.10 LINTELS

A. Steel Lintels: Fabricate from ASTM A36/A36M steel. Shop prime with one heavy coat of rust inhibitive, non-lead and non-chrome metal primer after fabrication unless noted otherwise.

2.11 MORTAR AND GROUT MIXES

A. Restoration Mortar: Proportioned by volume only; measure cementitious materials and sand in a dry condition. Do not measure by shovel; use known measure.
1. Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency.
2. Use mortar within 30 minutes after final mixing; do not add more water after the initial mix is prepared.
3. Sand: Match original mortar as closely as possible in color, size, and texture, without use of other additives.
4. Do not alter proportions, or use admixtures, unless permitted in writing by Contractor.
5. Pointing Mortar for Brick: 1 part Portland cement, 2 parts lime, and 8 to 9 parts sand.
6. Pointing Mortar for Stone: 1 part white Portland cement, 1 parts lime, and 6 parts sand.
7. Add mortar pigments only where required to match existing mortar colors.

B. Setting Mortar: ASTM C270, using the Proportion Specification. Type N, unless otherwise indicated; with cementitious material content limited to portland cement and lime.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
1. At Contractor, Self Consolidating Grout (SCG) can be used and must meet ASTM C 476 and the following requirements:
    a. T-20: 2 to 5 seconds.
    b. Visual Stability Index (VSI): zero (0).
    c. Slump Flow: Between 22 inches and 30 inches.

D. Mixing: Use clean mechanical batch mixer and comply with referenced standards. Ensure uniformity in measuring and mixing from batch to batch.

2.12 CLEANING SOLUTION MIXES

A. Use only clean potable water.
B. Provide heated water as required for proper cleaning product performance.
C. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical cleaner manufacturer.
D. Acidic Cleaner Solution for Brick: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.
E. Acidic Cleaner Solution for Stone: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned and restored are ready for work of this section.

3.02 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures, including but not limited to persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and adjacent buildings.
    1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
    2. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
    3. Keep wall wet below area being cleaned to prevent streaking from runoff.
    4. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
    5. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
    6. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, accessories, and downspouts; reinstall upon completion.
    1. Provide temporary rain drainage during work to direct water away from building.
C. Prevent mortar from staining face of surrounding masonry and other surfaces.
    1. Cover sills, ledges, and projections to protect from mortar droppings.
    2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
    3. Immediately remove mortar in contact with exposed masonry and other surfaces.
    4. Clean mortar splatters from scaffolding at end of each day.

3.03 UNUSED ANCHOR REMOVAL

A. Remove masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.

1. Remove items carefully to avoid spalling or cracking masonry.
2. If item cannot be removed without damaging surrounding masonry, cut off item flush with surface and core drill surrounding masonry and item as close around item as practical.

B. Patch holes where items were removed unless directed to remove and replace units.

3.04 BRICK MASONRY REMOVAL AND REPLACEMENT

A. At locations indicated, remove and replace entire area unless specifically indicated to remove only units that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
   1. When removing single bricks, remove material from center of brick and work toward outside edges.

B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Notify Architect/Engineer of Record of unforeseen detrimental conditions including voids, cracks, bulges, and loose masonry units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

D. Remove in an undamaged condition as many whole bricks as possible.
   1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
   2. Store brick for reuse, as indicated.
   3. Deliver cleaned brick not required for reuse to Owner, unless otherwise directed.

E. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

F. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

G. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67 initial rates of absorption of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid. Maintain joint width for replacement units to match existing joints.
   1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.

H. In areas of face wythe masonry removal and replacement 32 inches and more in height, provide corrugated ties secured to sound back-up masonry and bent to lay into bed joints to within 1/2 inch of outside face or new masonry at 16 inches OC vertically and 16 inches horizontally.

I. In areas of multi-wythe removal and replacement, provide homogeneous construction unless drawings indicate CMU or building brick internal wythe. In areas of 32 inches or more in height, provide masonry joint reinforcing 16 inches OC vertically and 16 inches OC horizontally.

3.05 STONE MASONRY REMOVAL AND REPLACEMENT

A. At locations indicated, remove stone that has deteriorated or is damaged beyond repair. Carefully demolish or remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.

B. Support and protect remaining stonework that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
C. Notify Architect/Engineer of Record of unforeseen detrimental conditions including voids, cracks, bulges, and loose masonry units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
D. Remove in an undamaged condition as many whole stone units as possible.
    1. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
    2. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.
    3. Store stone for reuse, as indicated.
    4. Deliver cleaned stone not required for reuse to Owner, unless otherwise directed.
E. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
F. Replace removed stone with other removed stone, where possible, or with new stone matching existing stone, including size. Butter vertical joints for full width before setting and set units in full bed of mortar, unless otherwise indicated. Replace existing anchors with new anchors of size and type indicated.
    1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.

3.06 PARTIAL STONE MASONRY REMOVAL AND REPLACEMENT (DUTCHMAN REPAIR)

A. At locations indicated, remove rectangular portion of stone units. Carefully remove stone by making vertical and horizontal saw cuts at face of stone and demolishing corner portion of stone unit to depth required for fitting partial replacement (Dutchman). Make edges of stone at cuts smooth and square to each other and to finished surface. Make back of removal area flat and parallel to stone face.
B. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.
C. Trim partial replacement (Dutchman) to accurately fit area where stone was removed.
D. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and partial replacement, completely filling all crevices and voids.
E. Apply partial replacement while adhesive is still tacky and hold securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of stone unit being repaired.
F. Clean residual adhesive from exposed surfaces and patch chipped areas and drill holes as specified in "Stone Patching" Article.

3.07 REANCHORING VENEERS

A. At locations indicated, install masonry repair anchors in horizontal mortar joints and according to manufacturer's written instructions. Install at not more than 16 inches o.c. vertically and 16 inches OC horizontally, unless otherwise indicated. Install at locations to avoid penetrating flashing.
B. Recess anchors at least 5/8 inch from surface of mortar joint and fill recess with pointing mortar.

3.08 LINTEL PREPARATION

A. Expose entire face and flange of lintel full length.
B. Examine for excessive deterioration. Immediately report section loss exceeding 20% of the cross-sectional area to Architect/Engineer of Record. Cover and protect form elements.
C. After approval to proceed, mechanically abrade to remove all rust to clean, bright metal. Utilize equipment having dust extraction device to avoid dust being scattered to the air. Conform to City of Chicago requirements.
D. Immediately upon exposure of bright metal, thoroughly work in metal primer with stiff bristle brush to provide complete coverage, minimum 3 mils dry.
E. After paint is thoroughly dry, apply through wall flashing extending from top of lintel to outside edge of support leg and provide stainless steel drip full length of lintel. Provide end dams. Install per manufacturer's recommendations. Provide cotton rope wicks near each end and 18 to 24 inches OC between.

3.09 LINTEL REPLACEMENT

A. Remove and replace steel lintels specified in Division 5 where indicated.
B. Carefully remove masonry from lintel in small lengths and provide shoring to support masonry above to prevent damage or displacement. Replace such damaged masonry as acceptable to Architect/Engineer of Record and Owner’s Representative at no cost to the Owner.
C. Remove and replace lintel level and true to location. Provide non-shrink grout at bearing locations.

3.10 REPOINTING MASONRY

A. Joint Raking:
    1. Rake out mortar from joints to depths equal to 2-1/2 times their widths but not less than l/2" (from face of original mortar) nor less than that required to expose sound, un-weathered mortar.
    2. Remove mortar from masonry surfaces within rakes-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum or flush joints to remove dirt and loose debris.
    3. Do not spall edges of masonry units or widen joints. Replace any masonry units which become damaged.
    4. Power operated rotary hand saws and grinders will be permitted based on submission by Contractor of a satisfactory quality control program and demonstrated ability of operators to use tools without damage to masonry. Saws and grinders shall be fitted with dust extraction system to prevent dust from being released in accordance with EPA, City of Chicago and other governing agency requirements. Quality control program shall include provisions for supervising performance and preventing damage due to worker fatigue and dust emissions.
        a. Where " soft" mortar is encountered, Contractor is to use a vacuum recovery system attached to the grinders. Its low strength and high particulate release define soft mortar during grinding. Recovery system must collect at least 95% of the grinding particles and associated dust and collect them in a closed drum. Close drums with appropriate covers before disposal.
    5. Upon completion of joint raking, Contractor must obtain approval from Architect/Engineer of Record before joint pointing commences.
B. Joint Pointing:

1. Rinse masonry joint surfaces with water to remove any dust and mortar particles. Time application of rinsing so that, at time of pointing, excess water has evaporated or run off, and joint surfaces are damp but free of standing water.
2. Apply first layer of pointing mortar to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8" until a uniform depth is formed. Compact each layer thoroughly and allow to become thumbprint-hard before applying next layer.
3. After joints have been filled to a uniform depth, place remaining pointing mortar in 3 layers with each of first and second layers filling approximately 2/5 of joint depth and third layer the remaining l/5. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing bricks have rounded edges recess final layer slightly from face. Take care not to spread mortar over edges onto exposed masonry surfaces, or to featheredge mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints, unless otherwise indicated. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in a damp condition for not less than 72 hours.
6. Where repointing work proceeds cleaning of existing masonry allow mortar to harden not less than 30 days before beginning cleaning work.

3.11 BRICK MASONRY PATCHING AND REPAIR

A. Replace whole bricks to match adjacent where damage requires patching or repair.

3.12 STONE PATCHING AND REPAIR

A. Spall Repairs:
   1. Carefully remove loose stone fragments in areas indicated to be repaired. Reuse only stone fragments that are in sound condition.
   2. Remove soil, loose stone particles, mortar, and other debris or foreign material from fragment surfaces to be bonded and stone from which fragments were removed by cleaning with stiff-fiber brush.
   3. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of fragments and stone from which fragments were removed, completely filling all crevices and voids.
   4. Fit stone fragments onto building stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured.
   5. After adhesive has fully cured, further anchor stone fragments where indicated with 1/4 inch diameter, plain stainless-steel rods set into 1/4 inch diameter holes drilled at a 45 degree downward angle through face of stone. Center and space anchor rods between 3 and 5 inches apart and at least 2 inches from any edge. Insert rods at least 2 inches into backing stone and 2 inches into stone fragments with end countersunk at least 3/4 inch from exposed face of stone.
   6. Clean residual adhesive from exposed surfaces and patch chipped areas and drilled holes.

B. Crack Repairs: Comply with cementitious crack filler manufacturer's written instructions.
   1. Drill 1/4 inch diameter, downward-sloping injection holes as follows:
      a. Transverse Cracks Less Than 3/8 inch wide: Drill holes through center of crack at 12 to 18 inches o.c.
      b. Transverse Cracks More Than 3/8 inch wide: Drill holes through center of crack at 18 to 36 inches o.c.

c. Delamination: Drill holes at approximately 18 inches o.c. both vertically and horizontally.
d. Drill holes 2 inches deep. Where possible drill holes in mortar joints.

2. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.
3. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other non-staining, removable plugging material. Leave openings at upper ends of cracks for air release.
4. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.
5. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.
6. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks.

C. Stone Patching:
1. Patch the following stone units:
a. Units indicated to be patched.
b. Units with holes.
c. Units with chipped edges or corners.
d. Units with small areas of deep deterioration.
2. Remove and replace existing patches, unless otherwise indicated or approved by Architect/Engineer of Record.
3. Cut out deteriorated stone and adjacent stone that has begun to deteriorate. Remove additional material so patch will not have feathered edges and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
a. Remove loose particles, soil, debris, oil, and other contaminants from existing stone units at locations to be patched by cleaning with stiff-fiber brush.
4. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
5. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
a. Trowel, scrape, or carve surface of patch to match texture and surface plane of surrounding stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
7. Keep each layer damp for 72 hours or until patching compound has set.
8. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

3.13 CLEANING MASONRY - GENERAL

A. Perform each cleaning operation in exact accordance with City of Chicago requirements including dust control and disposal of waste and water.

B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.
C. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Architect/Engineer of Record.
D. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas
E. Use only those cleaning methods appropriate for each masonry material and location as established by pre-cleaning testing program.
    1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
    2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
    3. Equip units with pressure gages.
    4. For chemical cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
    5. For water spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
    6. For high-pressure water spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
    7. For heated water spray application, use equipment capable of maintaining temperature between 140 and 160 degrees F at flow rates indicated.
F. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
    1. Clean each masonry material in sequence to avoid damage to adjacent differing materials and provide protection as required.
G. Removing Plant Growth: Completely remove plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.
H. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, caulking, asphalt, and tar.
    1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
    2. Remove paint and caulking with alkaline paint remover.
        a. Comply with manufacturer's requirements for paint removal.
        b. Repeat application up to two times if needed.
    3. Remove asphalt and tar with solvent-type paint remover.
        a. Apply only to asphalt and tar by brush without pre-wetting.
        b. Allow paint remover to remain on surface per manufacturer's requirements.
        c. Rinse off with water using low-pressure spray.
        d. Repeat application if needed.

I. Water Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

J. Chemical Cleaner Application Methods: Apply chemical cleaners to surfaces to comply with chemical cleaner manufacturer's written instructions; use brush or spray application methods, at Contractor's option. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

K. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
   1. Apply neutralizing agent and repeat rinse, if necessary, to produce tested pH of between 6.7 and 7.5.

L. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.14 PAINT REMOVAL

A. Paint Removal with Alkaline Paste Paint Remover if established by Pre-Cleaning Testing Program:
   1. Apply paint remover to dry, painted masonry with brushes.
   2. Allow paint remover to remain on surface for period recommended by manufacturer as established by pre-cleaning testing program.
   3. Rinse with water applied by pressure spray to remove chemicals and paint residue in accordance as established by the Pre-Cleaning Testing Program.
   4. Repeat process, if necessary, to remove all paint.
   5. Apply acidic cleaner to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner remain on surface for period recommended by chemical cleaner manufacturer as established by Pre-Cleaning Testing Program.
   6. Rinse with cold water applied by pressure spray to remove chemicals and soil as established by the Pre-Cleaning Testing Program.

B. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover if established by Pre-Cleaning Testing Program:
   1. Apply paint remover to dry, painted masonry with trowel, spatula, or as recommended by manufacturer as established by pre-cleaning testing program.
   2. Apply cover, if required by manufacturer, per manufacturer's written instructions.
   3. Allow paint remover to remain on surface for period recommended by manufacturer as established by Pre-Cleaning Testing Program.
   4. Scrape off paint and remover and collect for disposal.
   5. Rinse with water applied by pressure spray to remove chemicals and paint residue as established by pre-cleaning tea program.
   6. Use alkaline paste paint remover according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph, if necessary, to remove remaining paint.
   7. Apply acidic cleaner to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner remain on surface for period recommended by chemical cleaner manufacturer as established by Pre-Cleaning Testing Program.
   8. Rinse with cold water applied by pressure spray to remove chemicals and soil as established by Pre-Cleaning Testing Program.

C. Paint Removal with Solvent-Type Paint Remover if established by Pre-Cleaning Testing Program:

1. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
2. Allow paint remover to remain on surface for period recommended by manufacturer as established by Pre-Cleaning Testing Program. Agitate periodically with stiff-fiber brush.
3. Rinse with cold water applied by pressure spray to remove chemicals and paint residue as established by Pre-Cleaning Testing Program.

3.15 CLEANING BRICK

A. Detergent Cleaning if established by Pre-Cleaning Testing Program:
   1. Wet masonry with water applied by low-pressure spray.
   2. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
   3. Rinse with water applied by pressure spray to remove detergent solution and soil as established by Pre-Cleaning Testing Program.
   4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal if established by Pre-Cleaning Testing Program:
   1. Wet masonry with water applied by low-pressure spray as established by Pre-Cleaning Testing Program.
   2. Apply mold, mildew, and algae remover by brush or low-pressure spray as established by Pre-Cleaning Testing Program.
   3. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
   4. Rinse with water applied by pressure spray to remove mold, mildew, and algae remover and soil as established by Pre-Cleaning Testing Program.
   5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

C. Nonacidic Gel Chemical Cleaning if established by Pre-Cleaning Testing Program:
   1. Wet masonry with water applied by low-pressure spray as established Pre-Cleaning Testing Program m.
   2. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
   3. Let cleaner remain on surface for period indicated below:
      a. As established by Pre-Cleaning Testing Program.
   4. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
   5. Rinse with water applied by pressure spray to remove chemicals and soil as established by Pre-Cleaning Testing Program
   6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

D. Nonacidic Liquid Chemical Cleaning if established by Pre-Cleaning Testing Program:
   1. Wet masonry with water applied by low-pressure spray.

2. Apply cleaner to masonry in two applications by brush or low-pressure spray as established by Pre-Cleaning Testing Program. Let cleaner remain on surface for period if time as established by Pre-Cleaning Testing Program.
3. Rinse with water applied by pressure spray to remove chemicals and soil as established by Pre-Cleaning Testing Program.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

E. Mild Acidic, Acidic Chemical Cleaning if established by Pre-Cleaning Testing Program:
1. Wet masonry with cold water applied by low-pressure spray.
2. Apply cleaner to masonry in two applications by brush or low-pressure spray. Let cleaner remain on surface for period established by Pre-Cleaning Testing Program.
3. Rinse with cold water applied by pressure spray to remove chemicals and soil as established by Pre-Cleaning Testing Program.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

3.16 CLEANING STONE

A. Cold-Water Soak if determined by Pre-Cleaning Testing Program:
1. Apply cold water by prolonged spraying.
2. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
3. Remove soil and softened surface encrustation from stone with cold water applied by low-pressure spray.

B. Hot-Water Wash: Use hot water applied by pressure spray as established by pre-cleaning testing program.

C. Detergent Cleaning if established by pre-cleaning testing program:
1. Wet stone with water applied by low-pressure spray as established by the Pre-Cleaning Testing Program.
2. Scrub stone with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that stone surface remains wet.
3. Rinse with water applied by pressure spray to remove detergent solution and soil as established by Pre-Cleaning Testing Program.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

D. Mold, Mildew, and Algae Removal if established by Pre-Cleaning Testing Program:
1. Wet stone with water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray as established by Pre-Cleaning Testing Program.
3. Scrub stone with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that stone surface remains wet.
4. Rinse with water applied by [pressure spray to remove mold, mildew, and algae remover and soil as established by Pre-Cleaning Testing Program.

5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

E. Nonacidic Gel Chemical Cleaning if established by Pre-Cleaning Testing Program:
1. Wet stone with water applied by low-pressure spray.
2. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
3. Let cleaner remain on surface for period established by Pre-Cleaning Testing Program.
4. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
5. Rinse with water applied by pressure spray to remove chemicals and soil as established by Pre-Cleaning Testing Program.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

F. Nonacidic Liquid Chemical Cleaning if established by Pre-Cleaning Testing Program:
1. Wet stone with water applied by low-pressure spray.
2. Apply cleaner to stone by brush or low-pressure spray as established by Pre-Cleaning Testing Program. Let cleaner remain on surface for period indicated by Pre-Cleaning Testing Program.
3. Rinse with water applied by pressure spray to remove chemicals and soil as established by Pre-Cleaning Testing Program.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

G. Mild Acidic or Acidic Chemical Cleaning if established by Pre-Cleaning Testing Program:
1. Wet stone with cold water applied by low-pressure spray.
   a. Apply cleaner to stone by brush or low-pressure spray. Let cleaner remain on surface for period established by Pre-Cleaning Testing Program.
2. Rinse with cold water applied by pressure spray to remove chemicals and soil.
3. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use a steam wash.

H. One-Part Limestone Chemical Cleaning if established Pre-Cleaning Testing Program:
1. Wet stone with water applied by low-pressure spray.
2. Apply cleaner to stone by brush or low-pressure spray. Let cleaner remain on surface for period recommended by manufacturer or as established by Pre-Cleaning Testing Program.
3. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
4. Rinse with water applied by medium-pressure spray to remove chemicals and soil.

I. Two-Part Limestone Chemical Cleaning if established by Pre-Cleaning Testing Program:
1. Wet stone with water applied by low-pressure spray.
2. Apply alkaline prewash cleaner to stone by brush or roller. Let cleaner remain on surface for period recommended by cleaner manufacturer, unless otherwise indicated by Pre-Cleaning Testing Program.
3. Rinse with water applied by medium-pressure spray to remove chemicals and soil.
4. Apply acidic after-wash cleaner to stone in two applications, while surface is still wet, using low-pressure spray equipment, deep-nap roller, or soft-fiber brush. Let neutralizer

remain on surface for period recommended by manufacturer, unless otherwise indicated by Pre-Cleaning Testing Program.

5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by the Pre-Cleaning Testing Program. Do not repeat more than once.

3.17 FIELD QUALITY CONTROL

A. Owner may engage independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

3.18 CLEAN-UP

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.
B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
   1. Use wood scrapers, stiff-nylon or -fiber brushes. Do not use metal scrapers or brushes.
   2. Use clean water, spray applied at low pressures.
C. Clean surrounding surfaces.

END OF SECTION 04 01 00

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concrete Block / Concrete Masonry Units (CMU)

B. Clay facing brick.

C. Ceramic glazed structural clay facing tile.

D. Mortar and grout.

E. Reinforcement and anchorage.

F. Flashings.

G. Accessories.

1.02 RELATED SECTIONS

A. Section 04 01 00 – Maintenance of Masonry

B. Section 05 50 00 – Metal Fabrications

C. Section 07 62 00 – Sheet Metal Flashing and Trim

1.03 REFERENCE STANDARDS

A. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).

C. ASTM C331/C331M - Standard Specification for Lightweight Aggregates for Concrete Masonry Units; 2017.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

G. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.

H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

I. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.

J. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units; 2016.

K. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.

L. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2017a.

M. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

N. ASTM C150/C150M - Standard Specification for Portland Cement; 2017.

O. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

P. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2017a.

Q. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

R. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

S. ASTM C476 - Standard Specification for Grout for Masonry; 2016.

T. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2016.

U. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.

V. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

W. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

X. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

Y. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

Z. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

AA. ABIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

BB. ATMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

CC. AUL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers. Schedule meeting after initial submission of masonry submittals and initial brick matching has been submitted to Architect.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
      a. Require attendance by all affected installers including but not limited to
         1) Contractor's Superintendent
         2) Installer
         3) Manufacturer/Fabricator Representative
         4) Other affected Subcontractors
         5) Architect
         6) Owner Representative
   3. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect, Owner Representative and those affected by decisions made.

1.05 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data: Provide data for each type of masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
   1. Submit mix designs for each type of mortar and grout

C. Samples - Masonry Units: Submit three samples of each type of facing brick, CMU and ceramic glazed structural clay facing tile units to illustrate color, texture, and extremes of color range.

D. Samples - Mortar: Submit samples of colored mortar, showing the range of color which can be expected in the finished Work.

E. Manufacturer's Certificate - Masonry Units: Certify that each type of masonry units meets or exceed specified requirements.

F. Manufacturer's Certificate - Mortar: Certify that each type of mortar meets or exceeds specified requirements.

G. Manufacturer's Certificate - Reinforcing: Certify that each type of reinforcing meets or exceeds specified requirements.

1.06 QUALITY ASSURANCE

A. Obtain each type of masonry unit from one manufacturer, cured by one process and of uniform texture and color.

B. Do not change source or brands of masonry mortar materials during the course of the work.

C. Coordination: Review installation procedures and coordinate with other Work that must be integrated with masonry.

1.07 MOCK-UP

A. Provide initial brick panels with photographs taken on-site at each facility receiving masonry restoration scope to demonstrate color and texture match with existing for AOR review and approval.

B. Once brick and mortar matches are approved by Architect, provide Mock-Up of Masonry Unit construction for each material used, mock-up shall be at least 2'-0"x2'-0" in dimension, obtain approval from architect for proposed mock-up location(s). If accepted the mock-up(s) may be retained in place as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

C. Store cementitious materials off the ground, under cover, and in dry location.

D. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
      a. Provide bullnose block for outside corners, unless otherwise indicated.
   3. Compressive Strength: Minimum 1900 psi, unless otherwise indicated.
   4. Load-Bearing Units: ASTM C90, medium weight.
      a. Hollow block, as indicated.
   5. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Lightweight.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBX, Grade SW.
   1. Colors and textures to match existing restroom buildings as approved by Architect.
   2. Nominal size: Modular
   3. Compressive strength: Minimum of 1900 psi, measured in accordance with ASTM C67.
   4. Products and actual sizes as follows: Subject to compliance with requirements, provide the following products for incidental brick replacement to match adjacent work:

      Modular size, 3-5/8"D x 2-5/16"H x 7-5/8"L, select panel options to match existing conditions at each site. Provide multiple options for final color review and selection with photographs adjacent to existing conditions.

2.03 CLAY TILE UNITS

A. Contractor shall utilize salvaged existing material to greatest extent possible, where insufficient material can be retained, utilize new material as follows, mix with salvaged material for blended appearance, include in mock-up prior to work:

B. Manufacturers:
   1. Elgin Butler Company; www.elginbutler.com

C. Ceramic Glazed Structural Clay Facing Tile: ASTM C126; Grade S (Select); Types I and II, as indicated on drawings for various locations.

D. Color and texture to match existing color and finish where final installation is to be primed and painted.

E. Size: Match existing size and thickness.

F. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping to produce equivalent effect.

G. Color: Match existing (except in cases where incidental unit replacement are scheduled to receive paint).

2.04 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Masonry Cement: Not Acceptable

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.
   1. For joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect of Record from manufacturer's full range. Contractor to provide sample options photographed on-site adjacent to existing conditions for color match.
   2. Manufacturers:
      a. Bayer Corporation, Industrial Chemicals Div.: Bay ferrox Iron Oxide Pigments
      b. Davis Colors, a division of Venator Materials PLC; www.daviscolors.com
      c. Solomon Colors, Inc; www.solomoncolors.com

G. Water: Clean and potable.

H. Pointing Mortar for Prefaced or Specially Faced Unit Masonry: Factory mixed mortar conforming to ANSI A118.6.
   1. Manufacturers:
      a. Bostic; Hydrocement.
      b. Custom Building Products; Polyblend sanded.

c. Mapei; Keracolor sanded.

2.05 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

B. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Ladder.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

C. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Ladder.
2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
4. Basis of Design: Hohmann & Barnard, Inc. 270-2X Ladder Eye-Wire. Hook shall have a maximum offset of 1-1/4 inch.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
1. Steel frame: V-shaped 3/16 inch wire tie sections, hot-dipped galvanized after fabrication to ASTM A153/A153M, Class B.
a. Secure to concrete walls and columns where masonry anchors are indicated on the drawing, and where masonry passes or abuts the member.
1) Basis of Design: Hohmann & Barnard, Inc. VBT - Vee Byna-Tie

2.06 FLASHINGS

A. Membrane Asphaltic Flashing Materials:
1. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet; 30 mils (0.030 inch) minimum total thickness; 8 mil cross-laminated polyethylene bonded to adhesive rubberized asphalt, with a removable release liner.
a. Manufacturers:
1) Carlisle.
2) W. R. Grace.
3) Illinois Products Corp.
4) Polyguard.

B. Termination Bars: Stainless steel; compatible with membrane and adhesives.

C. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
1. Grade: 304, unless otherwise indicated.
2. Size: minimum 2 inches wide by 0.015 inch thick.

2.07 ACCESSORIES

A. Preformed Control Joints: Rubber or PVC material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width, self-expanding, in maximum lengths available.

C. Expansion Joint Seal: Precompressed, silicone coated.
   1. Basis of Design: Emseal; Colorseal; www.emseal.com

D. Bond Breaker Strips: Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.

E. Cleaning Solution: General purpose, non-acidic, cleaner by ProSoCo, Diedrich, or as recommend by masonry unit manufacturer.
   1. For Ground-Face Units: Sure-Kleen Burnished Custom Masonry Cleaner or as recommended by the manufacturer

2.08 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Exterior, non-loadbearing masonry: Type N.
   2. Interior, loadbearing masonry: Type N.
   3. Interior, non-loadbearing masonry: Type N.
   4. Interior, non-loadbearing masonry: Type O.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect of Record's sample, without exceeding manufacturer's recommended pigment-to-cement ratio. Unless otherwise indicated by manufacturer, pigments are not to exceed 10% of Portland cement by weight, or 5% of masonry/mortar cement by weight.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
   1. At Contractor's option, Self Consolidating Grout (SCG) can be used and must meet ASTM C 476 and the following requirements:
      a. T-20: 2 to 5 seconds.
      b. Visual Stability Index (VSI): zero (0).
      c. Slump Flow: Between 22 inches and 30 inches

D. Mixing: Use mechanical batch mixer and comply with referenced standards. Ensure uniformity in measuring and mixing from batch to batch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Start of work will indicate Contractor's acceptance of conditions.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and offsets.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602, and the following, when ambient air temperatures fall below 40 deg F.
   1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen work. Remove and replace masonry work damaged by frost or freezing
   2. Temperature of masonry units shall not be less than 20 deg F when laid in the assembly. Remove visible ice on masonry units before using the unit.
   3. Heat mortar sand or mixing water to produce mortar temperatures between 40 deg F and 120° F at the time of mixing. Maintain mortar above freezing until used in masonry.
   4. Use heat sources where ambient temperatures are between 20 deg F and 25 deg F, on both sides of the masonry under construction and install wind breaks when wind velocity is in excess of 15 mph.
   5. Where ambient temperatures are below 20 deg F, provide an enclosure for the masonry under construction and use heat sources to maintain temperatures above 32 deg F within the enclosure.
   6. Where mean daily temperatures are between 32 deg F and 40 deg F protect completed masonry from rain or snow by covering with a weather resistive membrane for 24 hours after construction.
   7. Where mean daily temperatures are between 25 deg F, and 32 deg F completely cover completed masonry with a weather resistive membrane for 24 hours after construction.
   8. Where mean daily temperatures are between 20 deg F and 25 deg F, completely cover completed masonry with insulating blankets or equal protection for 24 hours after construction.
   9. Where mean daily temperatures are below 20 deg F, maintain masonry temperature above 32 deg F for 24 hours after construction by enclosure with supplementary heat, by electric heating blankets, by infrared heat lamps, or by other acceptable methods.

B. Comply with requirements of TMS 402/602, and the following, when ambient air temperatures rise above 90 deg F.
   1. Do not spread mortar beds more than 4 feet ahead of laying masonry units and set units within one minute of spreading mortar.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Where new work abuts existing masonry work match existing coursing and tooth-in new brick veneer and CMU back-up into existing for a seamless appearance.

C. Brick Units:
   1. Bond: Running.
   2. Coursing: Two units and two mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

D. Clay Tile Units:
   1. Bond: To match existing adjacent work, or as directed by Architect.
   2. Coursing: One unit and one mortar joint to equal 8 inches.

3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
1. Avoid the use of less than half-size units at corners, jambs and wherever possible at other locations.

H. Discard units with cracked faces, chipped edges, or corners or other defects that affect appearance or performance.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

L. Rake-out joints ½" in Pre-Faced Units and SGFT, point with selected pointing mortar.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Provide continuity at corners and wall intersections by use of prefabricated “L” and “T” sections.

F. Place all anchors and ties, for secure anchorage and bonding of masonry.

G. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 32 inches horizontally and 16 inches vertically.

H. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.

I. Embed anchors and ties at least 1/2 inch in mortar of outer face shell of hollow units and 1-1/2 inch in mortar of solid masonry.

J. Provide minimum of 5/8 inch mortar cover for anchors, ties, and longitudinal wires of joint reinforcement when exposed to earth or weather and 1/2 inch mortar cover when not exposed to earth or weather.

K. Do not disturb or bend ties or anchors after embedding in grout or mortar.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 8 inches, minimum, to form watertight pan at non-masonry construction.
      a. Provide prefabricated pre-formed corner boots of rubberized asphalt flashing material for outside corners and flashing end dams at lintels, sills, inner corners and all other types of end terminations.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Provide continuous stainless steel drip edge at top of foundation walls and other locations indicated.
   1. Extend drip edge past opening to furthest end dam and make it symmetrical over openings.
   2. Provide two-piece stainless steel flashings free of burrs and sharp edges extended to fully conceal perimeter foundation insulation and extend min. 6” below finished grade, secure to wall using insulation manufacturer approved stainless fasteners and washers.

C. At steel lintels and shelf angles, install flashing on steel surface with no mortar above or below.

D. At masonry and concrete surfaces, install flashing with a full bed of mortar between flashing and course above. Seal flashing penetrations with manufacturer recommended mastic before covering with mortar.

E. Apply primer to all material in contact with flashing to maximize adhesion of through-wall flashing.

F. Extend flashing, uninterrupted, from outer wythe of masonry into the concrete masonry back-up. Terminate interior leg of flashing by extending flashing ½ the width of the concrete masonry unit backing wythe.

G. Carefully fit flashing around projections, columns, walls, etc. Form membrane to correct profile without wrinkles or buckles, and protect from entering the wall to the outside.

H. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.10 LINTELS

A. Install loose steel lintels over openings as indicated. Install plumb and level.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not indicated.
   1. Unless otherwise indicated, provide reinforcing as follows:
      a. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.
      b. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
   2. Provide 8 inches minimum bearing at each jamb for 8 inches wide units.
   3. Provide 12 inches minimum bearing at each jamb for 12 inches wide units.
   4. Place and consolidate grout fill without displacing reinforcing.
   5. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Locate loose angle lintels to provide room for flashing to provide a continuous drainage plane.

D. Provide end-dams at all flashings.

3.11 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Joints in brick masonry: Leave joints open for installation of joint filler, backer rod and sealant.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match Work immediately adjacent to the opening.

D. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

F. Fill cores in hollow units with grout minimum 3 courses (24-inches) under bearing plates, beams, lintels, posts and similar items unless otherwise indicated.

3.13 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 FIELD QUALITY CONTROL

A. The Contractor shall engage an independent testing agency to perform field quality control tests. Test results shall be shared with Owner and Architect to demonstrate compliance and for record, the contractor shall replace work that has been determined to be non-compliant with requirements.
   1. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67 requirements, sampling 5 randomly chosen units for each 5,000 square feet of wall area installed.
   2. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67 requirements, sampling 5 randomly chosen units for each 5,000 square feet of wall area installed.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for conformance to requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.15 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjacent units as intended. Provide new units to match adjacent units and install in fresh mortar, pointed to eliminate evidence of replacement.

D. Use non-metallic tools in cleaning operations.

E. Final Cleaning of Brick Work:
   1. After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as follows. Obtain Architect's acceptance of sample cleaning before proceeding.

2. Protect stone and non-masonry surfaces from contact with cleaner.
3. Protect landscape and soil from contact with masonry cleaner. Provide neutralizing solution application if contact occurs.
4. Mix and apply the cleaning agent as recommended by the manufacturer.
5. Apply the cleaning solution liberally with a natural fiber brush. Allow cleaning solution to remain on the wall for approximately 5 minutes. Do not allow the cleaning solution to dry on the wall.
6. Rinse thoroughly with fresh water at a pressure not to exceed 300psi with fan tipped nozzle.

3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Where one wythe of multi wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

D. Do not apply uniform floor or roof loads or concentrated loads for at least 3 days after constructing masonry walls or columns.

E. Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that comes in contact with such masonry.

F. Protect base of walls from rain-splashed mud and mortar splatter.

G. Protect sills, ledges, and projections from grout and mortar droppings.

H. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from grout and mortar droppings.

END OF SECTION 04 20 00

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Miscellaneous steel framing and supports.
2. Angle frames.
3. Metal floor plate and supports.
4. Miscellaneous steel trim.
5. Pipe guards.
6. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:
1. Section 09 91 13 “Exterior Painting”.
2. Section 09 91 23 “Interior Painting”.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturer’s written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Show adjacent materials and assemblies and connections to adjacent work.

C. Samples for Verification: For each type and finish of extruded tread.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturer, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code – Steel.”

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1, “Structural Welding Code – Steel.”
2. AWS D1.2, “Structural Welding Code – Aluminum.”
3. AWS D1.6, “Structural Welding Code – Stainless Steel.”

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

F. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: As indicated on drawings, but not less than 1-5/8 by 1-5/8 inches (41 by 41 mm).
   2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.
   3. Material: Cold-rolled steel ASTM A 1008, structural steel, Grade 33; 0.0528-inch minimum thickness; hot-dip galvanized after fabrication.

I. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

J. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

K. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

L. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening aluminum.
   2. Provide stainless-steel fasteners for fastening stainless steel.
   3. Provide stainless-steel fasteners for fastening nickel silver.
   4. Provide bronze fasteners for fastening bronze.

B. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or

ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

D. Post-Installed Anchors: Torque-controlled expansion anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting," and Section 09 91 23 Interior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.7 METAL GRATING

A. Standard-Duty Hot-Dipped Galvanized Bar Grating; 1-1/4”Hx3/16” thick bars spaced 1-3/16” on center with continuous cross bar fabricated from ¼” square twisted rod at 4” on center.
   1. Accessories:
      a. Hot-dipped Galvanized Steel Saddle Clip and Hardware assembly to secure grating to steel supports @24” o.c. max. ea. side.

B. Basis of Design: McNichols Item Number 6604310122 / Series GW-125, 19-W-4.
   1. Other manufacturer’s materials will be accepted subject to compliance with project requirements.

2.8 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:
   1. Thickness: 3/16 inch (4.8 mm), unless noted otherwise.

B. Provide steel angle supports as indicated.

C. Include steel angle stiffeners, and fixed and removable sections as indicated.

D. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.10 PIPE GUARDS

A. Fabricate pipe guards from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.

B. Galvanize pipe guards.

C. Prime pipe guards with zinc-rich primer.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.12 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Galvanize loose steel lintels located in exterior walls.

C. Prime loose steel lintels located in exterior walls with zinc-rich primer. Apply two coats of finish paint to all lintels after installation.

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with primers specified in Section 09 91 23 "Interior Painting" unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials,and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 “Exterior Painting” and Section 09 91 23 “Interior Painting.”

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sheathing.

B. Fascia nailers.

C. Preservative treated wood materials.

D. Miscellaneous framing and sheathing.

E. Communications and electrical room mounting boards.

F. Concealed wood blocking, nailers, and supports.

G. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

B. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

C. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2017.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

F. PS 1 - Structural Plywood; 2009.

G. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

H. PS 20 - American Softwood Lumber Standard; 2015.

I. SPIB (GR) - Grading Rules; 2014.

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials, application instructions, and fire retardant treatment materials.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir or Southern Pine, unless otherwise indicated.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01 60 00 - Product Requirements for requirements.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR), West Coast Lumber Inspection Bureau; WCLIB (GR), or Western Wood Products Association; WWPA (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19 at time of dressing and shipment for sizes 2 inches or less in nominal thickness.
   1. 2 Inches to 4 inches in Nominal Thickness: S-Dry or MC19.
   2. 1 Inch or Less in Nominal Thickness: Kiln-dried or MC15.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 1 or Construction Grade.
   2. Boards: No. 2.

2.03 CONSTRUCTION PANELS

A. Wall / Soffit Sheathing: Any PS 2 type.
   1. Bond Classification: Exterior.
   2. Grade: Structural I Sheathing.
   3. Span Rating: As required to support span spacing required inch.
   4. Performance Category: 5/16 PERF CAT.
   5. Edge Profile: Square edge.

B. Communications and Electrical Room Mounting Boards: MOD PS 1 A-D plywood; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Fasteners and Anchors: Provide size, type, material, and finish as indicated and as recommended by applicable standards and complying with Federal Standards.
   1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using ACQ (arsenic and chromium-free) preservatives to a minimum retention or 0.25 PCF.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber outside building enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by Chicago Building Code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
1. Wall brackets.
2. Grab bars.
3. Towel and bath accessories.
4. Wall-mounted door stops.
5. Wall paneling and trim.
6. Joints of rigid wall coverings that occur between studs.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Basic: Comply with the recommendations of APA Design/Construction Guide, Residential and Commercial, latest edition, of the American Plywood Association (APA). Provide thickness shown or, if not shown, provide as recommended by the APA for the spacing of supports and types of substrates involved in the Work.

B. Install with face grain across supports, using panels continuous over 2 or more spans with end joints between panels staggered and located over center of supports. Allow 1/8" spacing at panel ends and edges unless otherwise recommended by panel manufacturer.

C. Nail 6" o.c. along panel ends and 12" o.c. at intermediate supports using 6d common nails for panels 1/2" or less, 8d common nails for panels over 1/2" but less than 1" thick, and 8d ring shank or spiral thread nails or 10d common nails for panels 1" or more thick. For spans 48" or greater, space nails 6" o.c. at all supports.

D. Screw at 6” o.c. along panel edges and 12” o.c. at intermediate supports.

E. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. Nail panels to framing; staples are not permitted.

F. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

G. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

H. Wall Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.
1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
3. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.04 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.05 CLEANING

A. Waste Disposal: Dispose of materials legally.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 00

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

1.02 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If finish carpentry materials must be stored in other than the installation areas, store only where environmental conditions comply with requirements specified for installation areas.

B. Protect work from moisture damage. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indication that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

C. Protect work from moisture damage.

PART 2 - PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Interior Woodwork Items:
   1. Fascias and Miscellaneous Trim for Opaque Finish: Poplar or birch.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 60 00 - Product Requirements.

2.03 LUMBER MATERIALS

A. Solid Wood for Opaque (Painted) Finishes: Paint grade poplar or birch.

2.04 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fasteners: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

C. Concealed Joint Fasteners: Threaded steel.

2.05 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.06 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 5, Varnish, Conversion.
      b. Stain: As selected by Architect/Engineer of Record.
      c. Sheen: Satin.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.02 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 91 23.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION 06 20 00

SECTION 07 01 60

MAINTENANCE OF FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Repair of sheet metal work indicated on the drawings.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

B. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

C. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.

D. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007, with Editorial Revision (2012).

F. NRCA (RM) - The NRCA Roofing Manual; 2018.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

H. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2011.

I. SSPC-Paint 12 - Cold-Applied Asphalt Mastic (Extra Thick Film); 1982.

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Product Data: Provide product date on each type of product used.

C. Shop Drawings: Indicate layout, dimensions, and anchoring. Shop drawings for pre-engineering systems to be signed and sealed by engineer licensed in the State of Illinois.

D. Samples: Submit two metal samples, 4 by 4 inch in size, illustrating finish.

1.04 MOCKUPS

A. Coping and Roof Edge Mock-Up: Prepare a full size x 10' long mockup of coping/roof edge detail to demonstrate workmanship. Mockup to include welded joint and corner. Obtain Architect/Engineer of Record's acceptance of mock-up before installation of copings and roof edges.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Repair sheet metal to meet the following requirements:
   1. Withstand wind loads, and exposure to weather without failing.
   2. To be watertight and sloped to drain without ponding.
   3. Prevent galvanic action and other forms of corrosion.

B. If damage to sheet metal copings or cornice is suspected to be due to wind or by water run off which has not been corrected, notify Architect/Engineer of Record of conditions.

2.02 MATERIALS

A. Materials: Use same materials for replacement as existing materials. Furnish one of the following sheet metal materials to match existing as nearly as possible:
   1. Stainless-Steel Sheet: Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance.
   2. Zinc Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation; structural quality.

Fabricate sheet metal items in thickness or weight not less than that listed in the following schedule for each application and metal. Where schedule indicates NA (not applicable) the metal so indicated shall not be used in that applicatio

METAL APPLICATION	STAINLESS STEEL	GALV. STEEL
Gutter girth up to 20 Inches	0.0187 inch	0.0276 inch
Gutter girth 21 to 25 Inches	0.0250 inch	0.0336 inch
Gutter girth 26 to 30 Inches	0.0312 inch	0.0516 inch
Downspouts, conductor heads:	0.0156 inch	0.0217 inch
Splash Pans and Scuppers	0.0187 inch	NA
Built-in Gutters	0.0156 inch	NA
Exposed Trim, Gravel Stops, and Fasciae	0.0187 inch	0.0276 inch
Cornice	0.0250 inch	0.0217 inch
Counterflashing, flashing receivers, and reglets	0.0187 inch	0.0217 inch
Drip Edges	0.0156 inch	0.0217 inch
Minimum Thickness	0.0156 inch	0.0217 inch

2.03 MISCELLANEOUS MATERIALS

A. Solder: ASTM B32, Grade Sn50, used with rosin flux.

B. Solder for Stainless Steel: ASTM B32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

C. Fasteners: Same metal as sheet metal being repaired. Match finish of exposed heads with material being fastened.
   1. Replacement fasteners shall have larger shaft than existing fasteners to ensure positive mechanical engagement.
   2. Provide stainless steel fasteners or high humidity and preservative-treated wood locations

D. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur compounded for 15-mil dry film thickness per coat.

E. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

F. Elastomeric Sealant: Silicone type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00 - Joint Sealants.

G. Wind-Restraint Clips: Furnish clips to be installed to restrain edges of sheet metal work to prevent wind uplift of the exposed edge. Furnish same metal as being used for repair.
   1. Stainless steel, 0.0187 inch thick.
   2. Copper, 16 oz./sq. ft.
   3. Galvanized steel, 0.0217 inch thick.

2.04 SHEET METAL FABRICATION

A. Sheet Metal Fabrication Standard: Fabricate replacement sheet metal to comply with recommendations of SMACNA (ASMM) that apply to the design, dimensions, metal, and other characteristics of the item being repaired.

B. Patching Holes: Fabricate sheet metal to cover and lap existing sheet metal work. Seal laps and fasteners to Furnish in waterproof and weather-resistant performance. Attach sheet metal patch with fasteners. Solder joints to make water tight and seal fasteners.

C. Profiled Work: Fabricate sheet metal to match profile of existing work. Fabricate sheet metal to fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal. Attach sheet metal patch with fasteners. Solder joints to make water tight and seal fasteners.

D. Seams: Fabricate seams in sheet metal with interlocking seams. Tin edges to be seamed, form seams, and solder.

E. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic.

F. Conceal fasteners where possible. Do not use exposed fasteners on faces of sheet metal exposed to public view.

G. Fabricate cleats and attachment devices from same material as sheet metal being anchored.

PART 3 - EXECUTION

3.01 CLEANING

A. Clean exposed metal surfaces, prior to repair, removing substances that might cause corrosion of metal or deterioration of finishes. Clean surfaces to be patched which might prevent adhesion of sealants or solder.

3.02 INSTALLATION

A. Install sheet metal repairs to comply with performance requirements, and SMACNA (ASMM).
   1. Anchor units of Work securely in place, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated.
   2. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels, with exposed edges folded back to form hems.

C. Install sheet metal repairs to substrates and to result in waterproof and weather-resistant performance.

D. Expansion: Furnish for thermal expansion of exposed sheet metal Work. Do not span existing expansion joints. Furnish expansion joints where replacement work spans across existing expansion joint.

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Tin edges of sheets to be soldered to a width of 1-1/2 inches. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

F. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA (ASMM) standards. Fill joint with sealant and form metal to completely conceal sealant.

G. Underlayment: Where installing stainless steel directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.

END OF SECTION 07 01 60

SECTION 07 52 16.12

HOT APPLIED MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Configuration of a typical hot applied SBS modified bituminous membrane roofing system is to be assembled as follows:

Roofing Field Area:

a. Field-applied reflective coating (as specified), over;
b. One layer of granulated modified bitumen cap sheet in hot asphalt OR in cold adhesive, in lieu of hot asphalt, (at roofing manufacturer's option and per roofing manufacturer's recommendation - FOR CAP SHEET ONLY), over;
c. One layer of reinforced base ply sheet in hot asphalt adhesive, over;
d. One layer of Type VI glass-fiber ply sheet in hot asphalt, over;
e. Gypsum fiber or coated wood fiber cover board in hot asphalt adhesive, over;
f. Flat and/or tapered polyisocyanurate insulation (as specified), in hot asphalt adhesive, over;
g. The underlying deck assemblies with associated preparations (including vapor barriers/temporary roofs), as specified in Sections 3.06 thru 3.08 of this Specification.
h. Base Flashing Areas:
    1) Field-applied reflective coating (as specified), over;
    2) One layer of granulated modified bitumen cap sheet in hot asphalt OR in cold adhesive, in lieu of hot asphalt, (at roofing manufacturer's option and per roofing manufacturer's recommendation - FOR FLASHING CAP SHEET ONLY), over;
    3) One layer of Type VI glass-fiber ply sheet (backer sheet) in hot asphalt.

1.02 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.
B. ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures 2016.
C. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2022.
D. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022.
F. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).
G. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing 2016a.
H. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a (Reapproved 2021).
I. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method 1983 (Reapproved 2018).

J. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
K. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing 2004 (Reapproved 2020).
L. ASTM D4897/D4897M - Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing 2016.
M. ASTM D6162/D6162M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements 2021.
N. ASTM D6163/D6163M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements 2021.
O. FM 4470 - Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction 2016.
P. FM 4474 - Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures; 2004.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
   3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   4. Review preparation and installation procedures and coordinating and scheduling required with related work.
   5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   6. Review structural loading limitations of roof deck during and after roofing.
   7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   8. Review governing regulations and requirements for insurance and certificates if applicable.
   9. Review temporary protection requirements for roofing system during and after installation.
   10. Review roof observation and repair procedures after roofing installation.
   11. Require attendance by all affected installers including but not limited to
      a. Contractor's Superintendent
      b. Installer (roofer)
      c. Installer of substrate construction (roof decks)
      d. Manufacturer/Fabricator Representative
      e. Other affected Subcontractors
      f. Architect/Engineer of Record
      g. Owner’s Representative
      h. Owner's Testing and Inspecting Agency

i. Other entities directly concerned with performance of roofing system including (as applicable) Owner's insurers
j. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, Owner and those affected by decisions made.

1.04 SUBMITTALS

A. See PBC Book 2 for submittal procedures.
B. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, and vapor retarder.
C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work. Submit fully dimensioned layout drawings for:
   1. Joints, base flashings built-up termination condition and interface with other materials.
      a. Indicate details that meet wind related requirements of NRCA and FMG as required by this Section.
   2. Insulation fastening patterns for corner, perimeter, and field-of-roof locations, where mechanical fastening of components is required.
   3. For pre-engineered systems provide drawings and calculations signed and sealed by an Illinois licensed structural engineer (including wind pressure testing results).

D. Samples: Submit two samples 8 inches by 10 inches in size illustrating:
   1. Vented base sheet.
   2. Fastened base sheet.
   3. Reinforced field base ply sheet (Vapor Barrier/Temporary Roof).
   4. SBS-modified granulated cap sheet.
   5. Walkway pad.
   6. Roof insulation and cover board.
   7. Substrate board.
   8. Six base sheet and substrate board fasteners of each type, length and finish.
   9. Sample of manufacturer's standard pre-engineered, factory fabricated, prefinished aluminum ANSI/SPRI/FM 4435/ES-1 Coping / Roof Edge Flashing Profile and related mounting accessories.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements, including the following:
   1. Submit a letter on the letter head of the producer of the modified bitumen roofing system proposed for use, signed by a technical representative of the producer, stating the following:
      a. The system meets the specification and warranty requirements.
      b. The system will meet the initial and aged solar reflectance requirements.
      c. Any topcoat proposed for use will not void the FM and UL requirements specified.
      d. Any topcoat proposed for use will not delaminate or deteriorate to the point of requiring replacement for a period of five (5) years after application.
F. Installer Certificates: Submit certificate signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

G. Maintenance Data: Submit complete maintenance data for roofing system to include in maintenance manuals.
H. Manufacturer's Field (Inspection) Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given. Provide weekly inspection reports.
I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer's Roofing Inspector Qualifications: A full time Technical Representative of manufacturer (non-sales) experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection as required to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification.
    1. The presence and activity of the manufacturer's Technical Representative, Independent Representative and/or Owner's Representative shall in no way relieve the contractor of contract responsibilities or duties.
    2. It is the sole responsibility of the installing Contractor to contact the roofing manufacturer's inspector by phone on the morning of each day that roofing materials are being installed.
    3. The Manufacturer's Roofing Inspector shall be one of the following:
        a. An authorized full-time technical employee of the manufacturer with 10 years of experience in commercial roofing.
        b. If manufacturer does not employ full time technical personnel, inspection personnel shall be certified as a Registered Roof Observer by the Roof Consultants Institute, and shall be experienced in the installation and maintenance of the specified roofing system and qualified to determine Installer's compliance with the requirements of this Project.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, eligible to receive manufacturer's warranty, and approved by manufacturer.
C. General Performance: Installed hybrid hot applied SBS modified bitumen membrane roofing and hot applied SBS modified bitumen base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Hybrid hot applied SBS modified bitumen membrane roofing and hot applied SBS modified bitumen base flashings shall remain watertight.
D. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
E. No torch-down or self-adhering roofing products are acceptable on this project.
F. Solar Reflectance Index (SRI): Provide a hybrid modified bitumen roofing system that meets or exceeds: An initial reflectance value of 0.72 or a three-year installed value of 0.5 as determined by the Cool Roof Rating Council or Energy Star. Any product that has been rated by the Cool Roof Rating Council or by Energy Star shall display a label verifying the rating of the product.

G. Roofing System Design: Provide roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressures calculated according to ASCE 7-10. The Minimum Recommended Design Uplift-Resistance Capacities (Uplift Pressures) below include a safety factor of 2.0.
   1. All Zones (Roof Area Field, Roof Area Perimeter and Roof Area Corners) Uplift Pressures: As indicated on Drawings and as identified below:
      a. Zone 1 (Roof Area Field) Uplift Pressure: 28.9 lbf/sq. ft. (kPa).
      b. Zone 2 (Roof Area Perimeter) Uplift Pressure: 50.4 lbf/sq. ft. (kPa), located within feet (m) of roof perimeter edge.
      c. Zone 3 (Roof Area Corners) Uplift Pressure: 74.5 lbf/sq. ft. (kPa), located within 3 feet (m) of roof corner edge.

H. ANSI/SPRI Wind Design Standard: Manufacture and install pre-engineered perimeter aluminum coping and roof edge systems tested according to ANSI/SPRI/FM 4435/ES-1.
   1. No field fabricated metal copings or roof edge systems will be accepted.

I. FMG Listing: Provide hybrid hot applied SBS modified bitumen roofing membrane, base flashings, and component materials that comply with requirements in FM 4474 as part of a roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Windstorm Classification: FM Class 75
   2. Exterior Fire Classification: A
   3. Interior Fire Classification: NC
   4. Hail Resistance: SH

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture; ballast materials may be stored outdoors.

C. Protect foam insulation from direct exposure to sunlight, moisture, soiling, and other sources.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

E. Store modified bitumen rolls on end with selvage ends up.

F. Roll out the modified bitumen sheet and allow to relax for ten to fifteen minutes prior to installation.
   1. Cut into appropriate lengths.
   2. Install sheets parallel to slope as much as possible.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.

B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane when ambient temperature is below 40 degrees F.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
F. Consider effects of wind chill on adhesives and ensure they will not prematurely set before proper adhesion takes place.
G. Prevent all products from freezing. Store all materials prior to application at temperatures between 60 and 90 deg. F.
H. Prevent dust, vapors, gases, and odors from entering into the building during roof installation. When shutting down or blocking air intakes, provide makeup air or additional intake air from sources away from the work area. Coordinate these procedures with Owner's Representative.
I. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
    1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of coated roofing sheet set in urethane mastic with joints and edges sealed.
    2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
    3. Remove temporary plugs from roof drains at end of each day.
    4. Remove and discard temporary seals before beginning work on adjoining roofing.
    5. Provide protection in roof-related traffic, staging and storage areas consisting of 45 mil EPDM, 1" extruded polystyrene insulation, and 3/4" plywood ballasted with sandbags. Remove protection materials upon completion of work.
    6. Roofing Contractor to coordinate with General Contractor to provide protection for the installed vapor barrier/temporary roof and/or modified bituminous roofing system during all non-modified bituminous roofing system related construction activities.
J. Provide thermostatic controls and visual thermometer on bitumen kettle, maintain in working order, and keep calibrated.

1.08 WARRANTY

A. Manufacturer's Warranty: Provide warranty, without monetary limitation, in which manufacturer agrees to repair or replace components of roofing system, including but not limited to, vapor retarder roofing plies, modified membrane, adhesives, roof insulation, cover board, substrate board, wood components, fasteners, walkway products and all roof system metal caps and counter flashing, that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
    1. Warranty Period: 20 years from date of Preliminary Acceptance.
    2. Indicate a wind speed warranty of up to 74 M.P.H., as reported by the certified weather reporting station nearest to the site for the Chicago IL region.
    3. Contractor to provide a sample copy of standard roofing manufacturer's warranty, stating obligations, remedies, limitations, and exclusions of warranty as specified, with bid.
    4. Warranty shall run for a continuous 20 years.
        a. Warranty will not be accepted that contains any requirement(s) for Owner to renew the warranty at any time during the 20 year period.
        b. In year(s) number 2, 5, 10 and 15 of this warranty, manufacturer shall provide roof inspections with a written report, and limited housekeeping services, at no later additional charge to the Owner.

c. Lack of a written record that Owner performed regularly scheduled maintenance shall not void the warranty.

B. Installer's Warranty : Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, and all components of roofing system, including but not limited to, vapor retarder roofing plies, modified membrane, base flashings, adhesives, roof insulation, cover board, substrate board, wood components, fasteners, walkway products and all roof system metal caps and counterflashing, for the following warranty:

1. Warranty Period: Two years from date of Preliminary Acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Listed Manufacturers: The manufacturers listed below have demonstrated an ability to comply with the specified performance attributes for hybrid hot applied SBS modified bituminous membrane roofing assemblies. If one of the listed manufacturers chooses to use an acceptable product from another manufacturer, as listed in Sections 2.02 thru 2.12 of this Specification, the listed manufacturer must confirm in writing that the product is part of a RoofNav approved assembly and will be warranteed by the manufacturer. Subject to compliance with requirements, provide a hybrid hot applied SBS modified bituminous membrane roofing system warranteed by one of the following:

1. Garland.
2. Johns Manville.
3. Siplast.
4. Soprema.
5. Tremco.

2.02 SBS-MODIFIED ASPHALT SHEET MATERIALS (FOR ROOFING FIELD)

A. Granulated Cap Sheet: Meeting or exceeding ASTM D6163/D6163M, Grade G, Type II glass-fiber- reinforced, containing SBS-modified granulated surface (manufacturer's standard ceramic granules) with field-applied reflective roof coating as specified OR meeting or exceeding ASTM D6162/D6162M, Grade G, Type II composite of polyester and glass reinforcement containing SBS modified granulated surface (manufacturer's standard ceramic granules) with field-applied reflective roof coating as specified.

1. Acceptable glass-fiber reinforced SBS modified products, meeting or exceeding ASTM D6163/D6163M, Grade G, Type II:
   a. Garland StressPly FR Mineral
   b. Garland VersiPly Mineral
   c. Johns Manville DynaGlas FR XT
   d. Siplast Paradiene 30 HT FR
   e. Soprema Elastophene HR FR GR
   f. Soprema Elastophene HR FR GR WH
   g. Tremco Powerply Plus HT FR

2. Acceptable composite polyester and glass reinforced SBS modified products, meeting or exceeding ASTM D6162/D6162M, Grade G, Type II:
    a. Siplast Parafor 30
    b. Soprema Elastophene HS FR GR

2.03 BASE-PLY SHEET MATERIALS (FOR ROOFING FIELD)

A. Reinforced Base Ply Sheet: Composite of polyester and glass reinforcement coated with waterproofing asphalt, dusted with fine mineral surfacing on both sides, meeting or exceeding ASTM D4601/D4601M Type II OR glass reinforced SBS modified, meeting or exceeding ASTM D6163/D6163M, Grade S, Type II smooth, min. thickness 115 mils.
    1. Acceptable composite polyester and glass reinforced asphalt coated products, meeting or exceeding ASTM D4601/D4601M, Type II:
        a. Johns Manville Glastite Flexible
        b. Tremco Composite Ply HT
    2. Acceptable glass reinforced SBS modified products, meeting or exceeding ASTM D6163/D6163M, Grade S, Type II, with a minimum sheet thickness of 115 mils:
        a. Garland StressBase 120
        b. Johns Manville DynaBase XT-134 mil
        c. Siplast Paradiene 20 EG
        d. Soprema Elastophene HR sanded 3.0 (118 mils)

B. Fastened Base Sheet: Glass ply sheet, meeting or exceeding ASTM D4601/D4601M, Type I, as described in Section 3.06 of this specification.
    1. Acceptable glass base sheet products, meeting or exceeding ASTM D4601/D4601M, Type I:
        a. GAF Glas #75 Base, (Only if identified to be included in the system warranty by one of the Listed Manufacturers)
        b. Johns Manville Perma Ply 28
        c. Siplast Parabase
        d. Soprema Modified Sopra G
        e. Tremco BURmastic Glass Ply

C. Vented Base Sheet: Meeting or exceeding ASTM D4897/D4897M, Type II, as described in Section 3.06 of this specification.
    1. Acceptable vented base sheet products, meeting or exceeding ASTM D4897/D4897M, Type II:
        a. GAF Glas Stratavent, (Only if identified to be included in the system warranty by one of the Listed Manufacturers)
        b. Johns Manville Ventsulation Felt
        c. Soprema Sopra 4897

D. Reinforced Field Base Ply Sheet (Vapor Barrier/Temporary Roof): Composite of polyester and glass reinforcement coated with waterproofing asphalt, dusted with fine mineral surfacing on both sides, meeting or exceeding ASTM D4601/D4601M Type II OR glass reinforced SBS modified, meeting or exceeding ASTM D6163/D6163M, Grade S, Type II smooth, with a minimum sheet thickness of 115 mils, as described in Section 3.08 of this specification.
    1. Acceptable composite polyester and glass reinforced asphalt coated products, meeting or exceeding ASTM D4601/D4601M, Type II:

a. Johns Manville Glastite Flexible
b. Tremco Composite Ply HT

2. Acceptable glass reinforced SBS modified products, meeting or exceeding ASTM D6163/D6163M, Grade S, Type II, with a minimum sheet thickness of 115 mils:
   a. Garland StressBase 120
   b. Johns Manville DynaBase XT-134 mil
   c. Siplast Paradiene 20 EG
   d. Soprema Elastophene HR sanded 3.0 (118 mils)

2.04 PLY SHEET MATERIALS (FOR ROOFING FIELD)

A. Glass-Fiber Base-Ply Sheet: Meeting or exceeding ASTM D2178/D2178M, Type VI, asphalt-impregnated, glass-fiber felt.
   1. Acceptable asphalt-impregnated glass-fiber ply sheet products meeting or exceeding ASTM D2178/D2178M, Type VI:
      a. GAF FlexPly 6, (Only if identified to be included in the system warranty by one of the Listed Manufacturers)
      b. Garland HPR Premium Glasfelt (Type VI)
      c. Johns Manville Glas Ply Premier VI
      d. Soprema Sopra VI
      e. Tremco Thermaglass Premium VI

2.05 BASE FLASHINGS (FOR ROOF FLASHING AREAS)

A. Glass-Fiber Ply Sheet (Backer Sheet): Meeting or exceeding ASTM D2178/D2178M, Type VI, asphalt- impregnated, glass-fiber felt.
   1. Acceptable asphalt-impregnated, glass-fiber felt products meeting or exceedingASTM D2178/D2178M, Type VI.
      a. GAF FlexPly 6, Only if identified to be included in the system warranty by one of the Listed Manufacturers)
      b. Garland HPR Premium Glasfelt (Type VI)
      c. Johns Manville Glas Ply Premier VI
      d. Soprema Sopra VI
      e. Tremco Thermaglass Premium VI

B. Granulated Flashing Cap Sheet: Meeting or exceeding ASTM D6163/D6163M, Grade G, Type II glass- fiber-reinforced, containing SBS-modified granulated surface (manufacturer's standard ceramic granules) with field-applied reflective roof coating as specified OR meeting or exceeding ASTM D6162/D6162M, Grade G, Type II composite of polyester and glass reinforcement containing SBS modified granulated surface (manufacturer's standard ceramic granules) with field-applied reflective roof coating as specified.
   1. Acceptable glass-fiber reinforced SBS modified products, meeting or exceeding ASTM D6163/D6163M, Grade G, Type II:
      a. Garland StressPly FR Mineral
      b. Garland VersiPly Mineral
      c. Johns Manville DynaGlas FR XT
      d. Siplast Paradiene 30 HT FR

e. Soprema Elastophene HR FR GR
f. Soprema Elastophene HR FR GR WH
g. Tremco Powerply Plus HT FR

2. Acceptable composite polyester and glass reinforced SBS modified products, meeting or exceeding ASTM D6162/D6162M, Grade G, Type II:
a. Siplast Parafor 30
b. Soprema Elastophene HS FR GR

2.06 AUXILIARY ROOFING MEMBRANE MATERIALS

A. Primer: ASTM D41/D41M, asphalt type.
1. Acceptable asphalt primer products:
a. Garland Garlaprime VOC
b. Johns Manville Asphalt Primer
c. Siplast PA1125 Asphalt Primer
d. Soprema Elastacol 500
e. Tremco Tremprime LV

B. Asphalt Mastic: ASTM D4586/D4586M, Type I, Class I or Type II, Class I.
1. Acceptable asphalt mastic products:
a. Garland Flashing Bond
b. Johns Manville MBR Utility Cement
c. Siplast PA 1021 for Flat/Low Slope Application
d. Siplast PA 828 for Vertical Application
e. Soprema Sopramastic SBS Elastic Cement
f. Tremco ELS Mastic

C. Fluid-Applied Liquid Flashing: Roofing system manufacturer's standard single component, two-coat, cold, fluid-applied, moisture triggered, aliphatic polyurethane reinforced flashing membrane OR two-coat, reinforced PMMA (polyurethane methyl methacrylate) fluid applied products.
1. Acceptable aliphatic polyurethane products:
a. Tremco Alphaguard MT BC Polyurethane Base Coat / Tremco Alphaguard MT TC Polyurethane Top Coat
2. Acceptable PMMA (polyurethane methyl methacrylate) products:
a. Johns Manville SeamFree PMMA Flashing Resin (with Johns Manville SeamFree PMMA Catalyst & Johns Manville SeamFree PMMA Scrim)
b. Siplast Parapro 123 Liquid Flashing System
c. Soprema Alsan RS 230 Flash

D. Hot Applied Roofing Asphalt: ASTM D312/D312M, Type III, or IV as recommended by roofing system manufacturer for application.
1. Acceptable hot-applied roofing asphalt products:
a. Owens Corning Trumbull Asphalt, Trulo Odor 3
b. Owens Corning Trumbull Asphalt, Trulo Odor 4
c. Tremco Premium III
d. Tremco Premium IV

E. Cold Adhesive Option: At the roofing manufacturer's option, ONLY the granulated modified bitumen cap sheets in the roofing field or in the base flashing areas can be adhered in cold adhesive, in lieu of hot asphalt, per the roofing manufacturer's recommendations.
   1. Roofing system manufacturer's standard asphalt-based, one- or two-part, cold applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.
   2. Acceptable cold-applied adhesive products:
      a. Garland Weatherking Flashing Adhesive
      b. Johns Manville MBR Cold Application Adhesive
      c. Siplast PA-311 R
      d. Soprema Colply Adhesive
      e. Soprema Colply Modified Adhesive
      f. Tremco POWERply Cold Adhesive

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer. Use stainless steel fasteners where there is fastener contact with treated wood.

G. Field-Applied Reflective Roof Coating: White semi-gloss reflective coating acceptable to roofing system producer as required to produce the Solar Reflectance Index (SRI) specified under “QUALITY ASSURANCE” requirements and certified as required under “SUBMITTALS”.
   1. Acceptable field-applied reflective roof coating products:
      a. Garland Pyramic
      b. Garland White Knight
      c. Johns Manville Topguard 5000
      d. Siplast PC227 Elastomeric Coating
      e. Soprema R Nova Plus
      f. Tremco T-24 Coating

H. Drain Flashing Metal: 4 lb. (min.) lead sheet.

I. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.07 SUBSTRATE BOARDS

A. Substrate Board (Wood Decks, Metal Decks and Clay Tile / Book Tile Decks (without Concrete Topping)): A product recommended by the roofing system manufacturer, that is part of the manufacturer's tested assembly, and that is acceptable to the City of Chicago as providing a 15 minute thermal barrier between the interior of the building and the insulation.
   1. Board: 1/2" thick reinforced gypsum fiber substrate board, ASTM C1278/C1278M.
   2. Must be compatible with hot asphalt systems.
   3. Acceptable substrate board products meeting ASTM C1278/C1278M:
      a. Johns Manville Securock Gypsum Fiber Board
      b. Siplast / USG Securock Gypsum Fiber Board
      c. USG Securock Gypsum Fiber Roof Board
      d. Tremco / USG Securock Fiber Reinforced, Moisture Resistant Gypsum Roof Board

B. Fasteners : Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM 4470, designed for fastening substrate panel to roof deck. Use stainless steel fasteners where there is fastener contact with treated wood.

2.08 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class I, Grade 2, 20 psi, felt or glass-fiber mat facer on both major surfaces. Continuous flat stock insulation, specified tapered layout, or other flat stock R value as indicated on drawings. 2.6" maximum flat board thickness.
   1. Where 1/2” thick reinforced gypsum fiber board is used for an insulation cover board within a hot applied modified bitumen roofing system:
      a. The insulation field is to be comprised of 2.6” thickness insulation board.
   2. Where 1/2” thick wood fiber board is used for an insulation cover board within a hot applied modified bitumen roofing system:
      a. The insulation field is to be comprised of 2.5” thickness insulation board.
   3. Acceptable polyisocyanurate board insulation products:
      a. GAF Energy Guard Poly Iso Insulation
      b. Hunter H-Shield
      c. Johns Manville Energy 3 Polyisocyanurate
      d. Siplast Paratherm
      e. Soprema Sopra ISO
      f. Tremco Trisotech

2.09 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Hot Roofing Asphalt Insulation Adhesive: ASTM D312/D312M, Type III, or IV as recommended by roofing system manufacturer for application.
   1. Acceptable hot roofing asphalt insulation adhesive products:
      a. Owens Corning Trumbull Asphalt, Trulo Odor 3
      b. Owens Corning Trumbull Asphalt, Trulo Odor 4
      c. Tremco Premium III
      d. Tremco Premium IV

C. Low Rise Foam Insulation Adhesive: Manufacturer’s recommended low rise foam insulation adhesive. Two component (1:1 ratio), solvent free, asbestos free, elastomeric urethane adhesive.
   1. Acceptable low rise foam insulation adhesive products:
      a. GAF OlyBond 500 Adhesive Fastener
      b. Garland Insulock II
      c. Johns Manville MBR Cold Application Adhesive
      d. Siplast Parafast Insulation Adhesive (Large Areas)
      e. Siplast Parafast C (Small Areas)
      f. Soprema Duotack 365
      g. Tremco Low Rise Foam Insulation Adhesive Green

D. Insulation Cant Strip: Fiberboard, asphalt coated, ASTM C208, Type II, Grade I, Cellulosic-Fiber Insulation Board, 48 inches. Thickness: 2 inches Face: 4 inches.

E. Insulation Cover Board: 1/2" thick reinforced gypsum fiber roof board, ASTM C1278/C1278M OR 1/2" thick coated wood fiber board ASTM C208, Type II, Grade I or Grade II:
   1. A product recommended by the roofing system manufacturer.
   2. Must be compatible with hot asphalt and cold adhesive systems.
   3. Acceptable insulation cover board products meeting ASTM C1278/C1278M:
      a. Johns Manville Securock Gypsum Fiber Board
      b. Siplast / USG Securock Gypsum Fiber Board
      c. USG Securock Gypsum Fiber Roof Board
      d. Tremco / USG Securock Fiber Reinforced, Moisture Resistant Gypsum Roof Board
   4. Acceptable insulation cover board products meeting ASTM C208, Type II, Grade I or Grade II:
      a. Blue Ridge Structodek HD Fiberboard
      b. Celotex / Blue Ridge Structodek HD Fiberboard
      c. Siplast / Blue Ridge Structodek HD Fiberboard
      d. Tremco / Blue Ridge Structodek HD Fiberboard

2.10 PERIMETER METAL ROOF EDGE SYSTEM

A. Pre-engineered, Manufactured Perimeter Metal Roof Edge Flashing System: Tested and certified to meet ANSI/SPRI/FM 4435/ES-1 Wind Design Standards for Edge Systems.
   1. Parapet copings and roof edge profiles (including fascia / gravel stop profiles) shall be manufactured from 0.050” (minimum thickness) mill finished aluminum in 12’-0” maximum lengths.
      a. Provide factory mitered and welded corners, transitions and end caps. Coping profiles to be precision saw cut and continuously welded to produce a watertight joint.
         1) Inside and outside corners. No joints within 18 inches of corners. Maximum leg length is 30 inches.
         2) Transition miters.
         3) Offset miters.
         4) End caps. No joints within 18 inches of ends. Maximum leg length is 30 inches.
         5) All components to be from a single source supplier/fabricator.
      b. High Performance Coating: Two-coat, shop applied, 70% Polyvinylidene Fluoride (PVFD) coating. Color to be selected by architect from manufacturer’s full range of colors.
   2. Concealed coping splice plates to be installed at all coping joints.
      a. Coping splice plates shall be manufactured from 0.050” (minimum thickness) aluminum, 6 inch lengths, formed to fit the inside of the coping profile.
      b. Splice plates to be sealed factory applied, dual, non-hardening sealant strips.
      c. Splice plate finish to match coping or roof edge profile finish.
   3. Coping profiles to be snapped onto compression cleats manufactured from galvanized steel, 12 inch widths, with factory mounted stainless steel spring clips.
      a. Cleats to be fastened with stainless steel fasteners, sized per manufacturer’s recommendation.
   4. No exposed fasteners permitted.

B. Miscellaneous metal components and ancillary accessories to interface with the Pre-engineered, Manufactured Perimeter Metal Coping and Roof Edge Flashing System: Including, but not limited to, gutters, scuppers, counterflashings, expansion joint covers, etc.
   1. All miscellaneous metal components and ancillary accessories not requiring welding shall be manufactured from 0.040” (minimum thickness) mill finished aluminum in 12’-0” maximum lengths.
      a. Finished to match the Pre-engineered, Manufactured Perimeter Metal Coping and Roof Edge Flashing System.
   2. All slip metal components to be manufactured from 0.040” (minimum thickness) mill finished aluminum in 12’-0” maximum lengths.
      a. Finished to match the Pre-engineered, Manufactured Perimeter Metal Coping and Roof Edge Flashing System.
   3. ONLY where new slip metal is to be used at existing non-aluminum metal flashing components to remain in place, the new slip metal component is to match the metal type of the existing metal component. If galvanized steel is used, provide 24 ga. Minimum thickness.
      a. Finished to match the Pre-engineered, Manufactured Perimeter Metal Coping and Roof Edge Flashing System.
   4. Acceptable Pre-engineered, Manufactured Perimeter Metal Coping and Roof Edge Flashing System products:
      a. Garland R-Mer Edge
      b. Hickman
      c. Johns Manville Presto Lock Coping System
      d. Johns Manville Presto Tite Fascia System
      e. Metal Era
      f. Siplast Paraguard
      g. Soprema Sopraedge
      h. Soprema Sopraguard
      i. Soprema Sopracap
      j. Soprema Soprabond
      k. Tremco Tremlock

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
      a. Check roof drains prior to starting the roofing in each drainage area to determine if the drain is plugged, or if the drain bowl, clamping ring, dome, etc. are damaged. These items shall be brought to the attention of the Owner or Architect/Engineer of Record prior to starting work, and will be the Owner's responsibility for correction. Plugged or damaged drains brought to the attention of the Owner or

Architect/Engineer of Record after work has begun shall be the responsibility of the Contractor to correct.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. At Concrete Decks:
   a. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
   b. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
      1) Test for moisture by pouring 1 pint of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
4. At Wood Decks:
   a. Verify that deck wood is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 REMOVAL OF EXISTING EQUIPMENT

A. Examine substrate at location of removal/relocation/modification of mechanical units and mechanical lines (i.e. conduit and piping) :
   1. Verify with Architect/Engineer of Record before temporary removal of mechanical units. Perform a test run to ensure equipment is working properly before disconnection and temporary removal. Document all test results in writing.
   2. Remove and reset rooftop units as required. Coordinate downtime of the unit with the Owner. Provide work in stages or phases to accommodate the Owner's occupancy requirements. Keep existing mechanical equipment and services in operation as much as possible during construction.
   3. Reconnect mechanical equipment (on a daily basis if required), even when the disconnection of the equipment, or any portion thereof, is inadvertent.
   4. Electrical and/or mechanical extensions/connections found necessary shall be the Contractor's responsibility. Proper mechanical/electrical and ductwork extensions shall be provided where necessary by a licensed contractor to meet all state and local cod e requirements and to meet licensing requirements regarding the handling of chlorofluorocarbons (CFC's).
   5. Obtain and pay for all licenses and permits. Coordinate and request all inspections from authority having jurisdiction and submit certificates of inspection and final approval of the local inspection authority to the Architect/Engineer of Record.
   6. Verify with Architect/Engineer of Record before permanent reinstallation of mechanical units. Perform a test run to ensure equipment is working properly after reinstallation. Document all test results in writing.

3.03 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. At Concrete Decks:
   1. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal. I 100 sq. ft. and allow primer to dry.

3.04 ROOF DECK REPLACEMENT

A. Wood Deck Replacement:
   1. Remove and discard existing rotting or damaged roof deck wood members.
   2. Cut and fit replacement of roof deck wood members accurately. Install fire treated wood members true to line and level of existing decking.
   3. Securely fasten fire treated roof deck wood members to existing structural supports.
   4. Countersink fasteners on exposed fire treated roof deck wood members.
   5. Use stainless steel fasteners where there is fastener contact with treated wood.

B. Precast Plank Repair:
   1. Remove deteriorated and loose topping materials from top of planks to provide a good sound substrate for the installation and bonding of new repair materials utilizing tools and methods that will not result in cracking and breaking of tile units.
   2. Furnish a smooth transition between adjacent materials and new patches applied to roof deck. Grout adjacent member offsets with cementitious grout feathered to furnish a gradual transition.
   3. Furnish smooth, dry, solid and well anchored repairs to the top of the existing tile roof deck.
   4. Inspection: Inspect and test patched areas of the tile roof deck to confirm the integrity of the new installation.

3.05 ROOF INSPECTION AND TESTING.

A. The Owner will employ the services of a roofing consultant to perform the following services:
   1. Attend the roofing preinstallation conference.
   2. Provide full time observation of the Work and enforcement of the Contract Documents in accordance with good construction practice the first two days of installation and periodically thereafter.
   3. Direct the roofing installer to cut and patch one foot square samples as the installed roofing system minus the coating system and perform tests to determine such items as bitumen weight, interply mopping and moisture encapsulated within the roofing system at the site while Work is in progress one for 5,000 square foot of roof.
   4. If the test indicates failure to comply with Contract Documents, direct the roofing installer to make additional cut and conduct additional tests.
   5. Direct corrective action to obtain acceptance including removal and replacement if necessary.
   6. Insert the completed roofing system after application of coating system.

B. The roofing installer shall, as part of the Contract Work, perform the following:

1. Make all cuts as directed.
2. Immediately patch all cuts as required to obtain the specified warranty.
3. Perform all corrective work as directed.
4. Extend full cooperation.

3.06 SUBSTRATE BOARD INSTALLATION (AT WOOD DECKS WITHOUT CONCRETE TOPPING)

A. At Wood Decks:
   1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

3.07 VAPOR-BARRIER/TEMPORARY ROOF INSTALLATION

A. At Wood Decks without Concrete Topping):
   1. Over fastened substrate board, install one reinforced base ply sheet vapor barrier lapping each sheet minimum 4 inches over preceding sheet in shingle fashion. Embed each sheet in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.

B. At Concrete Decks:
   1. Prime concrete deck with asphalt primer and allow primer to dry. Install one reinforced base ply sheet vapor barrier lapping each sheet minimum 4 inches over preceding sheet in shingle fashion. Embed base ply sheet in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
      a. Roll ply into adhesive with a 4 inch side lap and a 6 inch end lap, minimum.
      b. Broom ply into adhesive from the dry side of the installation.
      c. Turn ply up at penetrations, walls and curbed units a minimum of eight inches (8") and seal with asphalt mastic.
      d. Use roofing system manufacturer's standard asphalt-based mastic for vapor barrier seal where roofing system manufacturer 's standard asphalt-based adhesive is used at steel and wood decks.

C. Completely seal vapor barrier at terminations, obstructions, and penetrations to prevent air and moisture movement into roofing system.

3.08 INSULATION INSTALLATION

A. Comply with roofing system manufacturer's written instructions for installing roof insulation.
B. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
C. Install tapered or flat stock insulation as shown on drawings to provide positive drainage.
D. Nailer Strips: Mechanically fasten 4-inch nominal- width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
   1. 20 feet apart for roof slopes greater than 2 inch per 12 inches (2:12) but less than 3 inches per 12 inches (3:12).
      a. Backnail 3 inches o.c. from the back edge of each ply along nailer to ensure that the nails are covered by a minimum of two plies of sheet. The nails shall be staggered.
   2. 48 inches apart for roof slopes greater 3 inches per 12 inches (3:12).
   3. Backnail 3 inches o.c. from the back edge of each ply along nailer to ensure that the nails are covered by a minimum of two plies of sheet. The nails shall be staggered.

E. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips in hot asphalt at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees.
F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
    1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
G. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
H. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
I. Sump insulation at roof drains and scuppers to provide a 48 inch by 48 inch sump.
J. Install adhered crickets between drains, at walls and perimeters between drains, and at other locations indicated on drawings.
K. Adhered Insulation: Install each layer of insulation and adhere as follows unless roofing system manufacturer requires otherwise. Comply with such requirements:
    1. Set each layer of insulation in solid mopping of hot roofing asphalt.
L. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.
    1. Apply in hot roofing asphalt.
M. Install adhered tapered edge strips (heights vary) at perimeter edges of roof to ensure no 90 degree bends exist in roofing.

3.09 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
    1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
    2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
    3. Remove and discard temporary seals before beginning work on adjoining roofing.
E. Asphalt Heating: Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application. Circulate asphalt during heating. Do not

raise asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating. Do not heat asphalt within 25 deg F of flash point. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.

1. Apply hot roofing asphalt within plus or minus 25 deg F of equiviscous temperature and adhere components to asphalt heated to not less than 425 deg F.

F. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.10 BASE-PLY SHEET AND PLY SHEET INSTALLATION

A. Install one layer of reinforced base ply sheet over one layer of Type VI glass-fiber ply sheet according to roofing system manufacturer's written instructions starting at low point of roofing system. Align reinforced base ply sheets and glass-fiber base-ply sheets without stretching. Extend base ply sheet and ply sheet over and terminate beyond cants.

1. Shingle side laps of glass-fiber base-ply sheets uniformly to ensure required base sheet and ply sheets covers substrate at any point. Shingle in direction to shed water.
2. Embed ply sheet and base ply sheet in a continuous mopping of hot roofing asphalt, to form a uniform membrane.

3.11 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install granulated SBS modified bituminous roofing membrane cap sheet over reinforced base ply sheet and Type VI glass-fiber ply sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Adhere to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F OR at the roofing manufacturer's option, ONLY the modified bitumen cap sheet can be adhered in cold adhesive, in lieu of hot asphalt, per the roofing manufacturer's recommendations.
2. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Install roofing membrane sheets so side and end laps shed water. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.

C. Immediately after installation of cap sheet, to ensure complete and continuous seal and contact between adhesive and base ply and ply sheets, including ends, edges and all laps without wrinkles, fish-mouths, or blisters:

1. Minimum 75-pound weighted roller shall be applied over entire adhered base ply and ply sheets at all areas including field of base ply and ply sheets, side laps and end laps.

D. Install modified bituminous membranes with side laps shingled with slope of roof deck. Nail off all roof plies into wood cants with 1” nails fastened 12” on center.

1. Seal all edges of new roofing at top of cants with asphalt mastic.

3.12 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
   1. Prime substrates if required by roofing system manufacturer.
      a. Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
      b. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F OR at the roofing manufacturer's option, ONLY the modified bitumen flashing cap sheet can be adhered in cold adhesive, in lieu of hot asphalt, per the roofing manufacturer's recommendations. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer OR at the roofing manufacturer's option, apply cold adhesive to the backside of ONLY the modified bitumen flashing cap sheet, in lieu of hot asphalt, per the roofing manufacturer's recommendations.

B. Extend base flashing up walls or parapets a minimum of 8 inches above built-up roofing and 6 inches onto field of built-up roofing.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
   1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

D. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

E. Roof Drains: Set 30-by-30-inch lead sheet drain flashing in bed of asphalt roofing mastic on completed roofing membrane. Cover lead sheet drain flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches beyond edge of lead sheet drain flashing onto field of roofing membrane. Clamp roofing membrane, lead sheet drain flashing, and cap sheet stripping into roof-drain clamping ring. Retap existing clamping ring bolt holes and provide new bolts at all existing drain bowl locations.

F. Install cap sheet stripping according to roofing system manufacturer's written instructions.

3.13 REFLECTIVE ROOF COATING

A. After entire roof system and flashing details are completed and roof system/laps/flashings have cured for 30 days, apply a uniform coating of the white semi-gloss reflective roof coating to roofing membrane, base flashings and walkway pads according to manufacturer's written instructions by roller or other suitable application method.

B. Apply two coats to roofing field and flashings in a neat and uniform manner.

3.14 FINAL FIELD INSPECTION

A. Manufacturer must provide a photo summary report, showing installation methods and conditions, to the Owner's Representative at the completion of the project.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect/Engineer of Record.
   1. Notify Architect/Engineer of Record or Owner 48 hours in advance of date and time of final inspection.

a. Results will be made available to Owner's Representative in written form. Any defects or entrapped moisture found within the new roofing system installation will be removed and replaced at the installing contractor's expense.

C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements

E. Contractor to repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.15 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect/Engineer of Record and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Preliminary Acceptance and according to warranty requirements.

C. Sequence operations to avoid excessive or concentrated foot traffic and storage over roof areas while they cure.

D. Clean all overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

E. Contractor shall rod all drains to ensure that a free flowing condition exists and all drains are functioning properly.

3.16 ROOFING INSTALLER'S WARRANTY

A. WHEREAS NAME of COMPANY, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: FPDCC
2. Address:
3. Building Name/Type:
4. Address:
5. Area of Work:
6. Acceptance Date:
7. Warranty Period:
8. Expiration Date:

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. Lightning;
   b. Peak gust wind speed exceeding 90 mph;
   c. Fire;
   d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. Vapor condensation on bottom of roofing; and
   g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this XX day of XXXXXXX, 20XX.
   1. Authorized Signature:
   2. Name:

3. Title:

END OF SECTION 07 52 16.12

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sheet metal flashing and trim as indicated on drawings and specified.

B. Sheet metal associated as referenced on drawings and in specifications.

C. Counterflashing of all curbs including, but not limited to, those of Mechanical and Electrical trades.

1.02 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Product Data
1. Submit sheet metal manufacturer's product specifications, installation instructions and general recommendations for standard factory fabricated items.
2. Submit data and color chart for prefinished sheet metal.

C. Samples:
1. Submit 6" square samples of specified sheet metals in specified gauges finished as specified.

D. Shop Drawings:
1. Submit Shop Drawings showing fabrication, jointing and securing of sheet metal. Show expansion joint details and connections to adjoining Work and at obstructions and penetrations.

1.03 QUALITY ASSURANCE

A. Fabricator/Installer: A company experienced in the type of Work required and acceptable to the Roofing Installer.

B. Reference Standards: Except as otherwise specifically shown or specified, comply with applicable recommendations and details of the "Architectural Sheet Metal Manual" by SMACNA.

C. Job Mock-Up: Prior to installation of work prepare a mock-up of each type and color of sheet metal flashing and trim for review and approval by Architect.

1.04 PROJECT CONDITIONS

A. Coordinate Work with adjacent Work, including installation of roofing to avoid leaving roofing terminations unprotected.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
   1. Factory-Painted Aluminum Sheet: ASTM B 209 (ASTM B209M), 3003-H14, with a minimum thickness of 0.040 inch (1.0 mm), unless otherwise indicated.
      a. Exposed Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer' written instructions.
      b. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Stainless-Steel Sheet: ASTM A 167, Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance; minimum 0.0187 inch (0.5 mm) thick, unless otherwise indicated.

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer, use a noncorrosive rosin flux over tinned surfaces.

B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer as specified below. Match finish of exposed heads with material being fastened. Designed to withstand design loads and recommended by manufacturer of primary sheet metal.
   1. General (blind fasteners or self-drilling screws): gasketed, with hex-washer head.
   2. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
   3. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
   4. Fasteners for Aluminum Sheet: Aluminum or series 300 stainless steel.
   5. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

C. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur compounded for 15-mil (0.4-mm) dry film thickness per coat.

D. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, nondrying, non-migrating sealant.

E. Elastomeric Sealant: Polyurethane based, one-part elastomeric sealant complying with ASTM C920, Type S, Grade NS, Class 25.

F. Epoxy Seam Sealer for Aluminum: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.

G. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

H. Metal Accessories: Furnish sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

I. Roofing Cement: ASTM D 4586, Type I, asphalt based.

J. Flexible Expansion Joint Covers: Furnish units consisting of exposed 60 mil neoprene sheet bellows; security anchored at both edges to sheet metal nailing flanges 3"-4" wide by special bifurcations formed in the metal, either plain or angle-formed to fit curbs as required; insulated from below with adhesively-applied closed cell; flexible, rubber/plastic insulation not less than 3/8" thick, coordinated with width of elastic sheet.
   1. Furnish sheet metal flanges matching counterflashing.
   2. Furnish shop fabricated corners and intersections.

2.03 FABRICATION

A. Fabricate sheet metal work to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated. Anchor units of work securely in place. Conceal fasteners where possible and set units true to line and level. Install Work with laps, joints and seams that will be permanently watertight and weatherproof.

B. Work free of oil canning, buckling, and tool marks and that is true to line and levels with exposed edges folded back to form hems. Install sheet metal work to fit substrates and to result in waterproof and weather resistance performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Fabricate nonmoving seams in sheet metal other than aluminum with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   1. Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

D. Space joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection.

E. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

F. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to view.

G. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
   1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

H. Fabricate extruded-aluminum running units with formed or extruded-aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

2.04 ALUMINUM FINISHES

A. General: Comply with Aluminum Association’s (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.
   1. Exposed Coil-Coated Finishes: Two-coat polyvinylidene fluoride finish containing not less than 70 percent Kynar 500/Hylar 5000 resins. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Colors:

a. Custom, as selected by the Architect to match the color and finish of exterior paint designated in architectural drawing and finish schedules and/or selected color of adjacent material where exposed to view.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Unless otherwise indicated, install sheet metal work to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place. Conceal fasteners where possible,and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal: Work free of oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal work to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pre-tinned surface would show in finished Work.
   1. Do not solder aluminum.
   2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   1. Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

E. Separate dissimilar metals from each other by painting each metal surface in area of contact with a heavy application of bituminous coating, or by other permanent separation as recommended by manufacturers of dissimilar metals.

F. Install Sheet metal Work with provisions for thermal expansion of running items of more than 15'-0" continuous length. Maintain a water-tight installation at expansion seams. Locate expansion seams as shown, or if not shown, at the following maximum spacings for each general flashing use:
   1. Cover-Type Expansion Joints: Furnish 4" wide cover plates of same metal and configuration of item to be joined. Set plates under units to be joined. Set units in full bed of non-skinning butyl mastic sealant allowing 1/4" gap between abutting ends of units for 40 deg F to 70 deg F temperature range.

G. Fabricate and install Sheet Metal Work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, waves and avoidable tool marks, considering temper and reflectivity of metal. Furnish uniform, neat seams with minimum exposure of solder, welds

and sealant. Except as otherwise shown, fold back sheet metal to form hem on concealed side of exposed edges.

H. Conceal fasteners and expansion provisions where possible in exposed Work, and locate so as to minimize possibility of leakage. Cover and seal Work as required for a watertight installation.
1. Furnish continuous cleat-type anchorages for trim.

I. Reglets:
1. Comply with unit manufacturer's recommendations for installation of built-in reglets to receive metal flashings.
2. Where required, Furnish 1" deep saw cuts, retaining bars and similar devices for securing edges of flashings to other Work.
3. Insert flashings into reglets and similar retainers, and Furnish mechanical anchorage as shown or, if not shown, as recommended by manufacturers of flashing and reglet devices. Seal flashing into reglet.
4. Where reglet or retainer does not furnish for snap-in anchorage of flashing, furnish wedges of lead or other compatible metal, spaced 2'-0" o.c., and driven well into retainer so as to be completely covered by sealant or filler.

J. Fascia Assemblies:
1. Set flanges in full bed of roofing cement over completed roof system (less trip-in) and nail with large head nails at 4" o.c. staggered, or as recommended by manufacturer for Manufactured gravel-stop / fascia assemblies.
2. Furnish jointing system specified herein before.

K. Installation of Stainless Steel Items:
1. Separate stainless steel from dissimilar metals, including regular steel and iron, and from cementitious materials.
2. Tin the edges of stainless steel to be soldered, for a width of 1-1/2", using solder for stainless steel and acid flux. Remove every trace of acid flux residue from metal promptly after tinning or soldering. Comply with manufacturer's recommended methods for cleaning and neutralization.
3. Furnish flat-lock seams, soldered, unless otherwise indicated, except at expansion joints. Remove residue of flex promptly and thoroughly.
4. Clean exposed surfaces of non-coated stainless steel of every substance, which is visible or might cause corrosion of metal surfaces. Exercise extreme care to remove fluxes and ferrous metal particles, including welding spatter and grinding dust.

L. Installation of Aluminum Items:
1. Where aluminum flashing is shown with contact to non-ferrous or ferrous metal, wood or cementitious materials, apply 15-mil bituminous coating or heavy trowel coating of roofing cement on substrate or as back-coating on flashing.
2. Furnish form flat-lock seams with epoxy seam sealer or other permanent sealer recommended by aluminum manufacturer except at expansion joints.
3. Clean exposed aluminum surfaces of every substance, which is visible or might cause corrosion of metal or deterioration of finish.

3.03 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Furnish final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07 62 00

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015a.

C. ASTM C834 - Standard Specification for Latex Sealants; 2017.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012 (Reapproved 2017).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

J. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

K. SWRI (VAL) - SWR Institute Validated Products Directory; Current Listings at www.swrionline.org.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
   3. Require attendance by all affected installers including but not limited to
      a. Contractor's Superintendent
      b. Installer

c. Manufacturer/Fabricator Representative
d. Other affected Subcontractors
e. Architect/Engineer of Record
f. Owner's Representative

4. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, Owner and those affected by decisions made.

1.04 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Sample product warranty.
7. Certification by manufacturer indicating that product complies with specification requirements.
8. SWRI Validation for Exterior Sealants: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards consisting of strips of cured sealants showing the full range of colors available for selection.

D. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

E. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

F. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver to manufacturer sufficient samples for testing.

5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

D. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect/Engineer of Record.

E. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Fail Procedure.
1. Sample: At least 18 inch long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

F. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.06 WARRANTY

A. See Book 2 for additional warranty requirements.

B. Correct defective work within a five year period after date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
a. Wall expansion and control joints.
b. Joints between door, window, and other frames and adjacent construction.
c. Joints between different exposed materials.
d. Openings below ledge angles in masonry.
e. Other joints indicated below.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
      1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
      2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
   c. Other joints indicated.
3. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-staining silicone sealant, unless otherwise indicated. Coordinate sealant selection with manufacturer's recommendations for use at adjacent materials.
1. Control and Expansion Joints in Concrete Paving (horizontal traffic surfaces): polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-staining silicone or polyurethane sealant, unless otherwise indicated. Coordinate sealant selection with manufacturer's recommendations for use at adjacent materials.
1. Non-Moving Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Moving joints in vertical surfaces and horizontal non-traffic surfaces: Non-staining silicone sealant or Polyurethane sealant.
3. Floor Joints (horizontal traffic): Polyurethane "traffic-grade" sealant.
4. Wet Areas (Locker Rooms, Toilet Rooms, Shower Areas): Mildew-resistant silicone sealant; white.
5. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
6. Swimming Pool and Pool Deck Expansion Joints: Polysulfide sealant.
7. Sound-Rated Assemblies: Acrylic emulsion latex sealant.

D. Interior Wet Areas: Locker rooms, toilet rooms, and shower areas; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

2.02 JOINT SEALANTS - GENERAL

A. Colors: As indicated on the drawings, or if not indicated as directed by Architect/Engineer of Record.

2.03 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: To be selected by Architect/Engineer of Record from manufacturer's full range.

5. Cure Type: Single-component, neutral moisture curing.
6. Products:
    a. Dow Chemical Company; 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
    b. GE Silicones: Silpruf.
    c. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.
2. Products:
    a. Dow Chemical Company; Dowsil: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
    b. GE Silicones: SCS 1700
    c. Pecora Corporation; 898NST: www.pecora.com/#sle.
    d. Tremco, Inc.: Tremsil 200.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses NT, M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect/Engineer of Record from manufacturer's full range.
3. Products:
    a. BASF: MasterSeal NP2.
    b. Pecora Corporation; Dynatrol II: www.pecora.com/#sle.
    c. Tremco Commercial Sealants & Waterproofing; Vulkem 227: www.tremcosealants.com/#sle.
    d. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com/#sle.
    e. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com/#sle.

D. Polyurethane "Traffic-Grade" Sealant: ASTM C920, Grade NS, Uses T, M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect/Engineer of Record from manufacturer's full range.
4. Products:
    a. BASF: MasterSeal NP2.
    b. Pecora: Dynatred.
    c. Tremco: THC-901.
    d. Tremco: Vulkem 116.

E. Polysulfide Sealant for Continuous Water Immersion: Polysulfide; ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; not expected to withstand traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect/Engineer of Record from manufacturer's full range.
3. Products:
    a. BASF: Sonolastic Polysulfide Sealant;
    b. Morton International, Inc: Thiokol 2P;
    c. Pecora Corporation; Synthacalk GC2+: www.pecora.com/#sle.

F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect/Engineer of Record from manufacturer's full range.

2. Products:
   a. BASF Corporation: Masterseal NP 520.
   b. Pecora Corporation; AC-20: www.pecora.com/#sle.
   c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Open Cell: 40 to 50 percent larger in diameter than joint width.
   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in under QUALITY ASSURANCE article.
   2. Notify Architect/Engineer of Record of date and time that tests will be performed, at least 7 days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.
   4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect/Engineer of Record.
   5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave per Figure 5A in ASTM C1193, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in under QUALITY ASSURANCE article.

B. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect/Engineer of Record immediately.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

D. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION 07 92 00

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Thermally insulated hollow metal doors with frames.
C. Hollow metal borrowed lites glazing frames.
D. Accessories, including glazing and matching panels.
E. Door and Transfer Grilles

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
    1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
    2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
    3. Require attendance by all affected installers including but not limited to
        a. Contractor's Superintendent
        b. Installer
        c. Manufacturer/Fabricator Representative
        d. Other affected Subcontractors
        e. Architect/Engineer of Record
        f. Owner’s Representative
    4. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, Owner and those affected by decisions made.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.
C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021.
G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

I. ASTM C476 - Standard Specification for Grout for Masonry 2020.
J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
K. City of Chicago Building Code - Municipal Code of Chicago, Title 14B, Building Code 2019.
L. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
O. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.
P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
R. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2019.
S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
T. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.
U. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.
V. UL (DIR) - Online Certifications Directory Current Edition.
W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
X. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Book 2 for submittal procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
C. Shop Drawings: Details of each frame type indicated on the Drawings, showing elevations, glazing, frame profiles, and any indicated finish requirements. Include type and locations of reinforcement.
D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.
E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
    1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
    2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
    3. Deansteel Manufacturing Company: www.deansteel.com
    4. LaForce: www.laforceinc.com

5. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
6. Pioneer Industries: www.pioneerindustries.com
7. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1, ADA Standards, and City of Chicago Building Code.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.
   5. Typical Door Face Sheets: Flush.
   6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   7. Reinforce doors and frames to recieve specifiied hardware.
   8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.
   1. Where requirements from different door and frame types conflict then the most stringent requirements shall be provided.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Extra Heavy-duty.
      b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.

3. Door Thermal Resistance: Unless otherwise indicated, provide thermal-rated assemblies with a maximum U-value of 0.500 or tested and certified in accordance with NFRC 100 for a maximum U-value of 0.700.
4. Door Thickness: 1-3/4 inches, nominal.
5. Weatherstripping: Refer to Section 08 71 00 - Door Hardware.

C. Interior Doors, Non-Fire Rated, Stile and Rail
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 3 - Stile and Rail.
d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
2. Door Thickness: 1-3/4 inch, nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Knock-down frames are not acceptable.
C. Frame Finish: Same as hollow metal door.
D. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
3. Weatherstripping: Separate, see Section 08 71 00 - Door Hardware.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, as specified in Section 09 91 13 - Exterior Painting and Section 09 91 23 - Interior Painting.

2.06 ACCESSORIES

A. Aluminum Faced Gypsum Panels:
B. Astragals for Double Doors:
1. Fire-Rated Doors: Steel, shape and thickness as required for fire rating.
C. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
D. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
E. Exposed Fasteners: Provide countersunk flat or oval heads for exposed screws and bolts unless otherwise indicated.
F. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on each side of center mullion of pairs, and 2 on head of pairs without center mullions.
G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 DOOR AND TRANSFER GRILLES

A. General: Except as otherwise indicated, provide manufacturer's heavy-duty wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Construction: Outer borders shall be constructed of heavy extruded aluminum and shall have countersunk screw holes for a neat appearance. Border shall be interlocked at the four corners and mechanically staked to form a rigid frame. Extruded aluminum inverted V-blades with a deflection shall be used to create a sight proof design and provide additional stiffness to the grille.

D. Types: Provide wall grilles of type, capacity, and with accessories and finishes as listed on schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Verify that finished walls are in plane to ensure proper door alignment.
D. Verify all required electrical and fire alarm work is completed and ready for installation of door frames.
E. Notify Architect/Engineer of Record of any unsatisfactory conditions affecting installation of doors and frames.
F. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
B. Install fire rated units in accordance with NFPA 80.
C. Install smoke rated units in accordance with NFPA 105.
D. Coordinate frame anchor placement with wall construction.
E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
F. Install door hardware as specified in Section 08 71 00 - Door Hardware.
G. Comply with glazing installation requirements of Section 08 80 10 - Glazing.
H. Coordinate and test installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Confirm full functionality of doors prior to Substantial Completion.

END OF SECTION 08 11 13

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling access door and frame units.

1.02 REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

E. Coordination Drawings: Reflected ceilings plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:
   1. Method of attaching door frames to surrounding construction.
   2. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.
   3. Wall-mounted items including access doors and frames.

1.04 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in “Submittals” Article.

PART 2 - PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Flush, Non-Fire-Rated, Wall-and Ceiling-Mounted Units with Trimless Frames:
   1. Location: Gypsum board.
   2. Material: Steel.
   3. Size: As indicated, unless otherwise required for application indicated.
   4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle, concealed pin type or continuous piano hinge.
   5. Lock: Key-operated cylinder lock.

B. Flush, Non-Fire-Rated, Wall-Mounted Units with Exposed Frames:
   1. Location: Masonry.
   2. Material:

a. Typical Locations: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
b. Toilet Rooms: Stainless steel, Type 304.

3. Size: As indicated, unless otherwise required for application indicated, 12 inch by 12 inch, minimum.
4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle, concealed pin type or continuous piano hinge.
5. Lock: Key-operated cylinder lock.

C. Fire-Rated Wall-Mounted Units with Trimless Frames:
1. Location: Fire-rated gypsum board.
2. Wall Fire-Rating: Match rating of separation in which located.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Material: Steel.
5. Size: As indicated, unless otherwise required for application indicated, 12 inch by 12 inch, minimum.
6. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle, concealed pin type or continuous piano hinge.
7. Automatic Closer: Spring type.
8. Latch: Self-latching bolt operated by key with interior release.

D. Fire-Rated Wall-Mounted Units with Exposed Frames:
1. Location: Fire-resistive masonry.
2. Wall Fire-Rating: Match rating of separation in which located.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Material: Steel.
5. Size: As indicated, unless otherwise required for application indicated, 12 inch by 12 inch, minimum.
6. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle, concealed pin type or continuous piano hinge.
7. Automatic Closer: Spring type hinge.
8. Latch: Self-latching bolt operated by key with interior release.

E. Recessed, Non-Fire-Rated, Wall-and Ceiling-Mounted Units with Trimless Frames:
1. Location: Gypsum board and acoustical panel ceilings.
2. Material: Steel.
3. Size: As indicated, unless otherwise required for application indicated, 12 inch by 12 inch, minimum.
4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle, concealed pin type or continuous piano hinge.
5. Latch: Screwdriver-operated cam latch with plastic grommet.
6. Lock: Key-operated cylinder lock.

2.02 WALL AND CEILING MOUNTED UNITS

A. Manufacturers:
1. J.L. Industries.
2. Karp.
3. Larsen’s.
4. Milcor, Inc: www.milcorinc.com/#sle.
5. Nystrom, Inc: www.nystrom.com/#sle.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Door Style: Single thickness with rolled or turned in edges.
2. Frames: 16 gage, 0.0598 inch, minimum thickness.

3. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
4. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
    a. Provide products listed by UL (FRD) as suitable for purpose indicated.
    b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
5. Steel Finish: Factory Primed; Field Painted to match ceiling/wall finish.
6. Stainless Steel Finish (at wet locations): No. 4 brushed finish.
7. Hardware:
    a. Hardware for Fire-Rated Units: As required for fire-rated listing indicated.
    b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    c. Handle: No handle.

C. Units in Fire-Rated Assemblies, General: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
1. Provide products listed by UL (FRD) as suitable for purpose indicated.
2. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.

D. Mounting Criteria:
1. Wall: Provide the following types with locations as indicated on Drawings.
    a. Recessed "trimless" frame and door surface flush with wall surface.
    b. Surface-mounted face frame and door surface flush with frame surface.
2. Gypsum Board:
    a. Recessed drywall bead frame with door surface flush with wall surface.
    b. Drywall bead frame with door surface flush with wall surface.
    c. Drywall bead frame with door surface recessed for infill for wall or ceiling finish
3. Plaster:
    a. Drywall bead frame with door surface flush with wall surface.
4. Masonry:
    a. Surface-mounted frame with door surface flush with frame surface.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect/Engineer of Record of unsatisfactory preparation before proceeding.

C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

D. Adjust doors and hardware after installation for proper operation.

END OF SECTION 08 31 00

SECTION 08 42 29

AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Low-energy operators for doors provided in other sections.

B. Operation: Provide equipment and controls required to achieve the following operation:
1. A switch to be remotely located as directed by the Owner that will release an electric strike at the exterior door followed by opening of the door with adjustable time delay.
2. A wall mounted hand's free motion activated device on both the exterior and interior of the building as indicated which will open the door.
3. An on/off, hold open key switch mounted in the jamb of the vestibule and entrance door.

1.02 DEFINITIONS

A. AAADM - American Association of Automatic Door Manufacturers.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work.
3. Confirm that power operator requirements have been fully coordinated with the work performed by others.
4. Require attendance by all affected installers including but not limited to
   a. Contractor's Superintendent
   b. Installer
   c. Manufacturer/Fabricator Representative
   d. Other affected Subcontractors
   e. Architect of Record
   f. Owner Representative
   g. Architect's Hardware Consultant
5. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect of Record, Owner's Representative and those affected by decisions made.

1.04 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. BHMA A156.19 - American National Standard for Power Assist and Low Energy Power Operated Doors; 2013.

C. NFPA 101 - Life Safety Code; 2017.

1.05 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data: Provide data on system components, sizes, features, and finishes.
   1. Include wiring diagrams.

C. Samples: Submit three samples of proposed aluminum finish for operator enclosure. Samples will be reviewed and approved for match of aluminum framing finish only.

D. Reports: Submit field quality-control test reports.

E. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

F. Maintenance Agreement: Submit three (3) signed copies of special maintenance agreement specified in this Section.

G. Maintenance Materials: Furnish the following for Owner’s use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Wrenches and other tools required for maintenance of equipment.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience, and a member of AAADM.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
   1. Certified by AAADM.

C. Source Limitations: Obtain Automatic Door Operators from one source from a single manufacturer.

1.07 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing automatic door operators. 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.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies.

1.08 MAINTENANCE SERVICE

A. Maintenance: Beginning at Substantial Completion, provide 12 months full maintenance by skilled employees of automatic door operator Installer. Include quarterly planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
   1. Engage inspector certified by AAADM to perform safety inspection after each adjustment or repair and at end of maintenance period. Submit completed inspection form to Board.
   2. Perform maintenance, including emergency callback service, during normal working hours.
   3. Include 24-hour-per-day, 7-day-per-week emergency callback service.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Dorma – Wave Touch Free 910TC w/ADA Logo.
   2. Other manufacturer's products will be considered subject to compliance with project requirements..

2.02 LOW-ENERGY, POWER OPERATORS FOR SWINGING DOORS (DOORS PROVIDED BY OTHERS)

A. General: Provide operators that comply with NFPA 101 and requirements of authorities having jurisdiction; size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operating System: Unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, and with manual operation including spring closing with power off.

C. Housing: Vandal-resistant, per mfr.

D. Exposed Cover: Vandal-resistant, per mfr.

E. Standard: Comply with BHMA A156.19.

F. Performance Requirements:
   1. Not more than 15 lbf applied 1 inch from latch edge of door to prevent stopped door from opening or closing.
   2. If power fails, not more than 30 lbf applied 1 inch from latch edge of door to manually set door in motion.

G. Operation: Power opening and spring closing. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
   1. Control speed of cycle by motor as dynamic brake.

H. Operating System: Electromechanical.

I. Microprocessor Control Unit: Solid-state controls.

J. Features:
   1. Adjustable opening and closing speed.
   2. Adjustable closing force.
   3. Adjustable backcheck.
   4. Adjustable latch speed.
   5. Adjustable hold-open time of not less than 0 to 30 seconds.
   6. Adjustable time delay.

K. Mounting: Surface.

L. Wall Push-Plate Switch: Per Mfr.

M. Low-Energy Automatic Door Operator Signage: Comply with BHMA A156.19.

2.03 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in hardware specification and as selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available and is of the correct characteristics.

C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 INSTALLATION

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

B. Low-Energy Power Door Operator Installation Standard: Comply with BHMA A156.19 and manufacturer’s instructions for installation.

C. Automatic Door Operators: Install door operator system, including control wiring.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

B. Adjust doors with low-energy door operators to close according to BHMA A156.19.

C. Readjust automatic door operators and activation and safety devices after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.

D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.04 FIELD QUALITY CONTROL

A. Testing and Inspecting: After installation has been completed, provide testing and inspecting of each automatic door operator by a party certified by AAADM to verify compliance with applicable BHMA standards.
   1. Inspection Report: Submit report in writing to Architect of Record and Contractor within 24 hours after inspection.

B. Remove and replace automatic door operators where test results indicate they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.05 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.06 CLOSEOUT ACTIVITIES

A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

B. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

END OF SECTION 08 42 29

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood and hollow metal doors.
B. Electrically operated and controlled hardware.
C. Lock cylinders for doors that hardware is specified in other sections.
D. Thresholds.
E. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00.01 - Door Hardware Schedule: Schedule of door hardware sets.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. BHMA (CPD) - Certified Products Directory Current Edition.
C. BHMA A156.1 - American National Standard for Butts and Hinges 2016.
D. BHMA A156.4 - American National Standard for Door Controls - Closers 2013.
E. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks 2014.
F. BHMA A156.6 - American National Standard for Architectural Door Trim 2015.
G. BHMA A156.7 - American National Standard for Template Hinge Dimensions 2016.
H. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000 2017.
I. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical 2015.
J. BHMA A156.16 - American National Standard for Auxiliary Hardware 2018.
K. BHMA A156.20 - American National Standard for Strap and Tee Hinges, and Hasps 2017.
L. BHMA A156.21 - American National Standard for Thresholds 2014.
M. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems Sponsor 2017.
N. BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems 2018.
O. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators 2013.
P. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
Q. BHMA A156.115W - American National Standard for Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.
R. DHI (H&S) - Sequence and Format for the Hardware Schedule 1996.
S. DHI (KSN) - Keying Systems and Nomenclature 1989.
T. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.

U. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.
V. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
W. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
X. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
Y. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
Z. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
C. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
    1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
    2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
    3. Review electrical roughing-in and preparatory work.
    4. Review construction keying and final keying.
    5. Require attendance by all affected installers including but not limited to
        a. Contractor's Superintendent
        b. Installer
        c. Manufacturer/Fabricator Representative (including availability for punch list walk-through)
        d. Other affected Subcontractors
        e. Architect/Engineer of Record
        f. Owner’s Representative
        g. Installer's Architectural Hardware Consultant (AHC).
        h. Hardware Installer.
    6. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, Owner and those affected by decisions made.
D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
E. Keying Requirements Meeting:
    1. Attendance Required:
        a. Contractor.
        b. Owner.
        c. Architect/Engineer of Record.
        d. Installer's Architectural Hardware Consultant (AHC).
        e. Hardware Installer.
    2. Agenda:
        a. Establish keying requirements.
        b. Verify locksets and locking hardware are functionally correct for project requirements.

c. Verify that keying and programming complies with project requirements.
d. Establish keying submittal schedule and update requirements.

3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   a. Access control requirements.
   b. Key control system requirements.
   c. Schematic diagram of preliminary key system.
   d. Flow of traffic and extent of security required.
4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect/Engineer of Record, Owner, participants, and those affected by decisions made.
5. Deliver established keying requirements to manufacturers.
6. Contractor, Door and Hardware supplier: Contact John Spargo at the Spargo Group to request hardware factory quote, Ofc PH: 630-516-9092 or email: jspargo@spargogroup.com.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
      a. Submit in vertical format, separate from door and frame schedules.
   3. List groups and suffixes in proper sequence.
   4. Provide complete description for each door listed.
   5. Provide manufacturers and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.

D. Hardware Schedule: Submit finished hardware schedule in a vertical format separate from door and frame schedule, conforming to "Sequence and Format for the Hardware Schedule" published by the Door and Hardware Institute (DHI). Horizontal and coded schedules are not acceptable.
   1. Finish Hardware Schedule Content: Based on the finished hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Schedules not having the following information will be rejected:
      a. Type, style, function, size and finish of each hardware item.
      b. Name and manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
      e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
      f. Mounting locations for hardware.
      g. Door and frame sizes and materials.

2. Submit schedule at earliest possible date, particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) that is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule. Review and acceptance by the Owner or Architect/Engineer of Record does not relieve Contractor of responsibility to fulfill requirements of Contract Documents.

E. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.
   1. Samples may be retrieved by the supplier. Units that are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

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

G. Keying Schedule: Submit after meeting with Owner's Representative for keying instructions.
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect/Engineer of Record and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section and has been furnishing hardware in the project's vicinity for not less than 2 years.

D. Source Quality Control: Obtain each type of door hardware as indicated from a single manufacturer and single supplier.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

B. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.

C. Inventory hardware jointly with representatives of the hardware supplier and the hardware installer until each is satisfied that the count is correct.

D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Warranty against defects in material and workmanship for period indicated, from Date of Preliminary Acceptance.
   1. Closers: Ten years, minimum.
   2. Deadbolt: Five years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
B. Provide individual items of single type, of same model, and by same manufacturer.
C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Applicable provisions of NFPA 101.
   4. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
   5. Listed and certified compliant with specified standards by FPDCC.
   6. Auxiliary Hardware: BHMA A156.16.
   7. Straps and Tee Hinges: BHMA A156.20.
   8. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   9. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   10. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Section 08 71 01 - Door Hardware Schedule for listing of hardware sets.
E. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide stainless steel screws for preservative treated wood substrates.
   5. Provide wall grip inserts for hollow wall construction.
   6. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
   7. Fire-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
   8. Provide concealed fasteners for hardware units that are exposed when door is closed, except to extent no standard units of the type specified are available with concealed fasteners. Do not use thru bolts for installation where bolt head or nut on the opposite

face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.

2.02 HINGES

A. Geared Continuous Hinges: Subject to compliance with requirements, provide the following products at exterior aluminum doors or at fire-rated doors having UL listed units equal to or better than the rating of the opening as indicated in Door Hardware Schedule or as follows:
   1. Architectural Builders Hardware (ABH), Inc.; Base of Design A101HD series: https://www.abhmfg.com/
   2. Hager/Roton: http://www.hagerco.com/
   3. Ives; an Allegion: https://us.allegion.com/en/home/products/brands/ives.html
   4. Stanley; https://www.stanleyhardwarefordoors.com/

2.03 LOCK CYLINDERS AND KEYING

A. General: Supplier shall meet with Owner to finalize keying requirements and obtain final instructions in writing. Comply with Owner's instructions for master keying and except as otherwise indicated, provide individual change key for each lock which is not designed to be keyed alike with a group of related locks.
   1. Refer to Section 08 71 00.01 Door Hardware Schedule, Part 2.01 Existing Project Conditions for the existing key system for the project.

B. Standard System: Except as otherwise indicated, provide new master key system for project. The following is standard system for keying hierarchy per FPDCC MASTER KEY ORGANIZATION.
   1. Great grand master
   2. Grand master: Principal and Building Engineer.
   3. Sub Master for the following areas and conditions:
      a. Exterior doors.
      b. Special Rooms: Including rooms such auditorium, gymnasium and special use classrooms.
      c. Single User Keys: Teacher's classroom key.

C. Lock Cylinders: Provide key access on the outside of each lock, unless otherwise indicated.
   1. Provide Best small format interchangeable core (SFIC) type cylinders, Grade 1, with seven-pin core in compliance with BHMA A156.5 at locations indicated.
   2. Provide cylinders from the same manufacturer as locking device.
   3. Provide cams and/or tailpieces as required for locking devices.

D. Provide construction cores and keys during the construction period. Construction control and operating keys and cores shall not be part of the Owner's permanent key system or be furnished in the same keyway as the Owner's permanent key system. Permanent core and keys shall be furnished by the hardware supplier direct to the Contractor as specified in Part 3. All cylinders shall be not less than six (7) pin interchangeable core and keyed into a new factory registered Grand Master Key System with a restricted keyway.

E. All cylinders shall be not less than six (7) pin interchangeable core keyed to the existing (insert manufacturer) registered Grand master Key system.

F. Permanent keys shall be stamped with the key system symbol (VKC). Do not mark the keys with the cylinder biting. Permanent cores shall be marked with the key system symbol in such a manner that the mark is not visible when the core is installed in the cylinder (CVKC).

G. Except where otherwise specified, locksets, cylinders and cores shall be by the same manufacturer, to assure proper operations.

H. During construction, all cylinder cores shall be keyed alike. The Contractor shall receive three (3) copies of this key. Under no circumstances shall the Contractor receive any of the

permanent building master keys or changes keys. The construction master key shall operate on no less than six (7) pins.

1. Quantity of Keys:
    a. 3 Great Grand Master.
    b. 3 Grand Master Keys.
    c. 3 Master Keys.
    d. 3 Keys per lock or cylinder.
    e. 50 key blanks.
    f. 3 Control keys.

I. For renovation projects, coordinate keying requirements with existing keying systems.

J. For the security of the key system all cores and keys will be delivered to the End User lock shops.

K. Installation of permanent cores and issuing of keys with be by the End User lock shop.

L. To Insure compatibility of cores and as the End User lock shop has support stock, Best locks and cylinders are preferred.

2.04 MORTISE LOCKS

A. General: Refer to Section 08 71 00.01 Door Hardware Schedule, Part 2.01 Existing Project Conditions for the existing lock manufacturer for the campus.

B. Manufacturers: Subject to compliance with requirements, provide products as indicated in Door Hardware Schedule or as follows:
    1. Best, dormakaba Group; 40Hseries: www.bestaccess.com/#sle.
    2. DORMA USA, Inc; M1000 Series: www.dorma.com/#sle.
    3. Sargent; an Assa Abloy Group company; 8200 series: www.assaabloydss.com/#sle.
    4. Schlage, an Allegion brand; L9000 series: www.allegion.com/us/#sle.

C. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
    1. Locks shall have all functions available in one size case, manufactured from heavy gauge steel, minimum thickness 3/32 inch, completely chrome plated for corrosion resistance and lubricity of parts. Cases shall be closed on all sides to protect internal parts. Locks shall have adjustable, beveled and armored fronts, secured with spanner head security screws. Standard 2-3/4-inch backset convertible from one function to another, with a full 3/4-inch throw two-piece, or approved one-piece anti-friction latch bolt and 1" throw dead bolt with hardened steel insert and available for a minimum door thickness of 1-3/4 inch. Internal parts shall be heavy gauge steel, zinc dichromate-plated and nickel steel hubs.
    2. All locksets with latch bolts, regardless of trim, shall be listed by UL for A and lesser labeled doors, single or pairs.
    3. Lock trim shall be solid stainless-steel levers with wrought rose, through bolted through the lock case to assure correct alignment.
    4. Lockset shall conform to, and be certified as meeting, ANSI A156.13 Grade 1 requirements.
    5. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
        a. Finish: To match lock or latch.

2.05 DOOR PULLS AND PUSH PLATES

A. Manufacturers: Subject to compliance with requirements, provide products indicated in Door Hardware Schedule or a comparable product by one of the following:

1. Hiawatha, Inc, an Activar Construction Products Group company: www.activarcpg.com/hiawatha/#sle.
2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Ives, an Allegion brand: www.allegion.com/us/#sle.
4. Trimco: www.trimcohardware.com/#sle.
5. Provide 316 stainless steel for push and Pull Plates.

B. Concealed Fasteners: Provide manufacturer's special concealed fastener system for installation; through-bolted for matched pairs, but not for single units. Pulls to have 2-1/2 inch clearance from face of the door to the underside of the pull.

2.06 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products in the Door Hardware Schedule or one of the following:
1. Sargent; an Assa Abloy Group company; 281 Series: www.assaabloydss.com/#sle.
2. DORMA USA, Inc; 8900 Series: www.dorma.com/#sle.
3. LCN, an Allegion brand; 4040 Series: www.allegion.com/us/#sle.
4. Norton, 7500 Series.

B. Closers: Comply with BHMA A156.4, Grade 1.
1. Type: As indicated in door hardware sets.
2. Provide door closer on each exterior door.
3. Provide doors closer on each fire-rated and smoke-rated door.
4. Closers shall be rack and pinion construction with both rack and pinion of heat-treated steel and with a cast iron or cast aluminum case. Closing the door will be controlled by 2 valves, one to control closing speed and one to control latching speed. Closers shall be regularly furnished with fully adjustable backcheck allowing approximate 70 degrees backcheck on both regular and parallel are closers. Delayed action shall be available. Valves shall be concealed against unauthorized adjustment and non-critical needle valve type. Spring power adjustment shall be standard with an adjustment size 1 to size 6. Closers shall be surface applied with rectangular metal covers, void of manufacturers' trademarks. All door closers intended to be mounted to the door shall be furnished with thru-bolts and sex nuts. Furnish exterior closers with manufacturer's standard all-weather fluid designed to prevent freezing.
5. Size of units: Except as otherwise specifically indicated, comply with the manufacturer’s recommendations for size of door control unit depending upon size of door, exposure to weather and anticipated frequency of use.
6. Provide heavy duty arms.
7. Provide spring cushion stops on parallel arm closers.
8. Provide heavy duty dead stop parallel arms on doors equipped with electric hold open/release devices.
9. Provide all necessary plates, brackets, arms, and shoes required for proper installation of closer.

2.07 PROTECTION PLATES - GENERAL

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Hiawatha, Inc, an Activar Construction Products Group company: www.activarcpg.com/hiawatha/#sle.
3. Ives, an Allegion brand: www.allegion.com/us/#sle.
4. Trimco: www.trimcohardware.com/#sle.

B. Protection Plates: Comply with BHMA A156.6.
C. Metal Properties: Stainless steel.
   1. Metal, Standard Duty: Thickness .050-inch, minimum.
D. Edges: Beveled, on three sides unless otherwise indicated, with vertical finish.
E. Fasteners: Countersunk screw fasteners.

2.07A ARMOR PLATES

A. Armor Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
   1. Size: 48” inch high by 2 inch less door width (LDW) on push side of door, unless otherwise indicated. Provide 316 Stainless Steel Owners Standard and Identified hardware schedule.

2.08 KICK PLATES

B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
   1. Size: 15 inch high by 2 inch less door width (LDW) on push side of door, unless otherwise indicated. Provide 316 Stainless Steel Owners Standard and Identified hardware schedule.

2.09 MOP PLATES

C. Mop Plates: Provide along bottom edge of push side of doors to provide protection from cleaning liquids and equipment damage to door surface.
   1. Size: 6 inch high by 1-inch less door width (LDW) on pull side and 2-inch LDW on push side of door. Provide 316 Stainless Steel Owners Standard and Identified hardware schedule.

2.10 CONCEALED OVERDOOR STOPS

D. Manufacturers: Subject to compliance with requirements, provide products indicated in Door Hardware Schedule or a comparable product by one of the following:
   1. Architectural Builders Hardware (ABH), Inc.: https://www.abhmfg.com/
   2. Dorma USA, Inc; 910S Series: www.dorma.com/#sle.
   3. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   4. Ives, an Allegion brand: www.allegion.com/us/#sle.
E. Door Holders: Comply with BHMA A156.8, Grade 1.

2.11 THRESHOLDS

F. Manufacturers: Subject to compliance with requirements, provide products indicated in Door Hardware Schedule or a comparable product by one of the following:
   1. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Legacy Manufacturing: www.legacyllc.com/#sle.
   3. National Guard Products, Inc: www.ngpinc.com/#sle.
   4. Zero International, Inc: www.zerointernational.com/#sle.
G. Thresholds: Comply with BHMA A156.21.
   1. Field cut threshold to profile of frame and width of door sill for tight fit.
   2. Provide stainless steel fasteners at exterior locations.

2.12 WEATHERSTRIPPING AND GASKETING

H. Manufacturers:
   1. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Legacy Manufacturing: www.legacyllc.com/#sle.
   3. National Guard Products, Inc: www.ngpinc.com/#sle.
   4. Zero International, Inc: www.zerointernational.com/#sle.

I. Weatherstripping and Gasketing: Comply with BHMA A156.22.
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, as schedule.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.
   3. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

2.13 KEY CONTROL SYSTEMS

J. Key Control Systems: Comply with guidelines of BHMA A156.28.
   1. Provide keying information in compliance with DHI (KSN) standards.
   2. Keying: Great grand master keyed.
   3. Supply keys in following quantities:
      a. 3 each Master keys.
      b. 3 each Grand Master keys.
      c. 3 each Great Grand Master keys.
      d. 3 Keys per lock or cylinder.
      e. 50 key blanks.
      f. 3 Control keys.
   4. Key Management System: For each keyed lock on project, provide two sets of consecutively numbered duplicate key tags with hanging hole and snap catch.
   5. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
   6. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
   7. Standard Master Key Hierarchy:
      a. Great-Grand Master opens all doors.
      b. AA opens all individually keyed doors for the mechanical rooms, electrical rooms, communication rooms, and yard equipment storage.
      c. AB opens all individually keyed: washrooms.
      d. B opens all individually keyed exterior doors (BA).
      e. C opens all individually keyed storerooms doors (CA).

2.14 FINISHES

K. Finishes: Identified in Door Hardware sets scheduled.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 PREPARATION

A. The contractor shall notify hardware supplier two weeks prior to beginning of hardware installation to set up pre-installation meeting with installation carpenters. Hardware supplier shall provide a qualified Architectural Hardware Consultant to personally meet with and instruct installers on job site in proper techniques for installation and adjustment of locks, closers and exit devices, and advise on required wire types and gauges for access control/electrical locking hardware.

3.03 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.
B. Use templates provided by hardware item manufacturer.
C. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise in Door Hardware Schedule or on drawings.
    1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
    2. For Aluminum-Framed Storefront Doors and Frames: Refer to Section 08 43 13 - Aluminum Framed Storefronts.
    3. Mounting heights in compliance with ADA Standards:
        a. Locksets: 40-5/16-inch max.
        b. Push Plates/Pull Bars: 42-inch max.
        c. Deadlocks (Deadbolts): 48-inch, ax.
D. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal, anchor thresholds with stainless steel countersunk screws.
    1. Refer to Section 07 92 00 - Joint Sealants for additional requirements.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.
B. Lock, Door and Closer Manufacturer' s representative shall be available for a post installation walk and punch list assistance on behalf of the General Contractor, Architect/Engineer of Record, and Owner.
C. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.05 KEYING AND ADJUSTING

A. Permanent cores and keys shall be delivered by the hardware supplier directly to the contractor at the keying meeting. The contractor and representative of the hardware supplier shall jointly install the permanent cores in the presence of the Owner’s Representative who shall receive the keys. The hardware supplier shall return the construction cores and construction keys to the manufacturer.
B. Adjust work under provisions of Section 01 70 00 - Execution Requirements.

C. Adjust hardware for smooth operation.
D. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.06 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
B. Clean adjacent surfaces soiled by hardware installation.
C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.07 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution Requirements.
B. Do not permit adjacent work to damage hardware or finish.

3.08 CONTINUED MAINTENANCE

A. Continued Maintenance Service: Approximately three months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project, and re- adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

BEMIS WOODS GROVE # 6

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE BOATING CENTER

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR

1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. DOOR SWEEPS 7823CA 628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE ELK PASTURE

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD 628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 630 DOR (EXTERIOR SIDE ONLY)
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S. 630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 SET HEAD/JAMB SEALS 5623CA 628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA 628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA 628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5” 630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK 626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S. 630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. DOOR SWEEPS 7823CA 628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE FOREST CENTRAL GROVE # 4

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5" X 4.5"	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4"" STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE FOREST MAIN DAM GROVE # 26

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR

2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE FOREST MAIN DAM GROVE # 27

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG

1 EA. RABBETED THRESHOLD 356MA MSA 628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5” 630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK 626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 630 TRI
316 S.S.
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. DOOR SWEEPS 7823CA 628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE FOREST SOUTH GROVE # 24

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD 628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 630 DOR
(EXTERIOR SIDE ONLY)
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” 630 TRI
SECURITY FASTENERS
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 630 TRI
316 S.S.
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 SET HEAD/JAMB SEALS 5623CA 628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA 628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA 628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE FOREST WEST GROVE # 31

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI

1 EA. DOOR SWEEPS 7823CA 628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

BUSSE NED BROWN GROVE # 28

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD 628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 630 DOR (EXTERIOR SIDE ONLY)
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" 630 TRI SECURITY FASTENERS
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 630 TRI 316 S.S.
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 SET HEAD/JAMB SEALS 5623CA 628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA 628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA 628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5" X 4.5" 630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4"" STK 626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 630 TRI 316 S.S.
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. DOOR SWEEPS 7823CA 628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.
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BUSSE RESERVOIR GROVE # 17

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5" X 4.5"	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4"" STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

DAN RYAN WOODS GROVE # 2

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR

1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	630 TRI
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

DAN RYAN WOODS GROVE # 4

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG

1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	630 TRI
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

DAN RYAN WOODS GROVE # 9 VISITOR CENTER

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2” OA 13 GAUGE	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E (EXTERIOR SIDE) 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS (INTERIOR)	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

DAN RYAN WOODS GROVE # 10

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E (EXTERIOR SIDE) 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS (INTERIOR)	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5" X 4.5"	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4"" STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

DAN RYAN WOODS GROVE # 16

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR

1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E (EXTERIOR SIDE) 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS (INTERIOR)	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT KEYED AND THUMB TURN M1960T X 2-3/4”” STK	626 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

EGGERS WOOD GROVE # 2

HARDWARE SET – 1

DOOR MEN’S RESTROOM, WOMEN’S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE LOCK DEADBOLT KEYED BOTH SIDE M1968T LGH 2-3/4” STK	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.

EVANS FIELD GROVE # 1

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2" OA 13 GAUGE	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E (EXTERIOR SIDE) 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS (INTERIOR)	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL ROOM

3 EA. HINGES FBB191 4.5" X 4.5" NRP	630 BES
1 EA. MORTISE DEADBOLT WITH THUMB TURN M1960T X 2-3/4"" STK	630 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2" OA 13 GAUGE	630 TRI
1 EA. PUSH PLATE 1001-9 6" X 16" SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

FOREST GLEN WOODS

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2" OA 13 GAUGE	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E (EXTERIOR SIDE) 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS (INTERIOR)	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5" X 4.5"	630 BES
1 EA. MORTISE DEADBOLT WITH THUMB TURN M1960T X 2-3/4"" STK	630 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

GREEN LAKE WOODS

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR

1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5” X 4.5”	630 BES
1 EA. MORTISE DEADBOLT WITH THUMB TURN M1960T X 2-3/4”” STK	630 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI

1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

I & M CANALBICYCLE TRAIL

HARDWARE SET – 1

DOOR NO. 461-1 (SWING OUT)

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2” OA 13 GAUGE	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E (EXTERIOR SIDE) 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS (INTERIOR)	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR

1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 1A

DOOR NO. 461-2 (SWING IN)

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4” STK INDICATOR 79019 (EXTERIOR SIDE)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48” X 2” LDW .050 B4E (316 S.S.) ENGRAVE “PUSH” SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL ROOM

3 EA. HINGES FBB191 4.5” X 4.5” NRP	630 BES
1 EA. MORTISE DEADBOLT WITH THUMB TURN M1960T X 2-3/4”” STK	630 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2” OA 13 GAUGE	630 TRI
1 EA. PUSH PLATE 1001-9 6” X 16” 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4” X 16” .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 EA. KICK PLATES K0050 – 15” X 2” LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

LABAGH WOODS GROVE # 2

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2" OA 13 GAUGE	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E (EXTERIOR SIDE) 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS (INTERIOR)	630 TRI
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5" X 4.5"	630 BES
1 EA. MORTISE DEADBOLT WITH THUMB TURN M1960T X 2-3/4"" STK	630 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	630 TRI
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS	630 TRI
1 EA. DOOR SWEEPS 7823CA	628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

LINNE WOODS GROVE # 1

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH

1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 630 DOR (EXTERIOR SIDE only)
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" 630 TRI SECURITY FASTENERS
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 630 TRI 316 S.S.
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 SET HEAD/JAMB SEALS 5623CA 628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA 628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA 628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL CHASE ROOM

3 EA. HINGES FBB191 4.5" X 4.5" 630 BES
1 EA. MORTISE DEADBOLT WITH THUMB TURN M1960T X 2-3/4"" STK 630 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 630 TRI 316 S.S.
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. DOOR SWEEPS 7823CA 628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

RIVER OAKS GOLF COURSE CLUB HOUSE

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

3 EA. HINGES FBB191 4.5" X 4.5" 630 BES
1 EA. PUSH PLATE 1001-9 6" X 16" ENGRAVE "PUSH" 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 630 TRI 316 S.S.
1 EA. ADA OPERATOR ED100LE PULL ARM 628 DOR
1 EA. WALL STOP 1270WV 630 TRI
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. MOP PLATES KM050 – 6" X 1" LDW .050 B4E 316 SS. SECURITY FASTENERS 630 TRI

2 EA. ACTUATOR WALL SWITCH WS-1 (HARD WIRED) 630 DOR

CONDUIT, WIRING AND ROUGH-IN BY ELECTRICIAN.
SIGNAGE BY OTHERS. SEE DOOR TYPES.

SCHILLER WOODS GROVE # 9

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD 628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 630 DOR
(EXTERIOR SIDE ONLY)
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2" OA 13 GAUGE 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E (EXTERIOR SIDE) 630 TRI
316 S.S. SECURITY FASTENERS
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" 630 TRI
SECURITY FASTENERS (INTERIOR)
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 SET HEAD/JAMB SEALS 5623CA 628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA 628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA 628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

HARDWARE SET – 2

DOOR MECHANICAL ROOM

3 EA. HINGES FBB191 4.5" X 4.5" NRP 630 BES
1 EA. MORTISE DEADBOLT WITH THUMB TURN M1960T X 2-3/4"" STK 630 DOR
1 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC 626 DOR
1 EA. LATCH PROTECTOR 5001 9-1/2" OA 13 GAUGE 630 TRI
1 EA. PUSH PLATE 1001-9 6" X 16" 316 S.S. SECURITY FASTENERS 630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 630 TRI
316 S.S.
1 EA. DOOR CLOSER 8916FHP FRICTION HOLD OPEN PARALLEL ARM SNB 689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES 689 DOR
1 EA. KICK PLATES K0050 – 15" X 2" LDW .050 B4E 316 S.S. SECURITY FASTENERS 630 TRI
1 SET HEAD/JAMB SEALS 5623CA 628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA 628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA 628 LEG

SEE DOOR TYPES.
INSTALL KICKPLATES ON THE PUSH SIDE.
PUSH PLATES AND PULL PLATES PREP FOR CYLINDERS AND THUMB TURN.

TAMPIER EAST BOATING

HARDWARE SET – 1

DOOR MEN'S RESTROOM, WOMEN'S RESTROOM

1 EA. CONTINUOUS HINGE A110HD	628 ABH
1 EA. MORTISE DEADBOLT KEYED BOTH SIDE M1962T 2-3/4" STK INDICATOR 79019 (EXTERIOR SIDE ONLY)	630 DOR
2 EA. PERMANENT CORE 77XX 7 PIN MKD BEST CORE SFIC	626 DOR
1 EA. ARMOR PLATE KA050-48" X 2" LDW .050 B4E (316 S.S.) ENGRAVE "PUSH" SECURITY FASTENERS	630 TRI
1 EA. HANDS FREE PULL PLATES 1035-3-4" X 16" .050 X B4E SECURITY FASTENERS 316 S.S.	630 TRI
1 EA. DOOR CLOSER 8916FH FRICTION HOLD OPEN REGULAR ARM SNB	689 DOR
1 EA. CONCEALED OVERHEAD STOPS 910S SERIES	689 DOR
1 SET HEAD/JAMB SEALS 5623CA	628 LEG
1 EA. BRUSH DOOR SWEEPS 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA MSA	628 LEG

SIGNAGE BY OTHERS. SEE DOOR TYPES.
ARMOR PLATES AND PULL PLATES PREP FOR CYLINDERS.

END OF SECTION 08 71 00

SECTION 08 91 00

LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2015.
D. AMCA 511 - Certified Ratings Program for Air Control Devices 2010.

1.03 SUBMITTALS

A. See PBC Book 2 for submittal procedures.
B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames. Include connection details to adjacent construction.
D. Samples: Submit two samples 6 x 6 inches in size illustrating finish and color of exterior surfaces.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory assembled louvers to project site in manufacturers, unopened packaging.
B. Store louvers under cover and elevated above grade. Maintain product labels.
C. Protect finish from damage during storage and installation.

1.06 WARRANTY

A. See PBC Book 2 for additional warranty requirements.
B. Provide five year manufacturer warranty against distortion, metal degradation, and failure of connections.
    1. Finish: Include coverage against degradation of exterior finish, for the following time period after Preliminary Acceptance.
        a. 10 years for anodized finishes.
        b. 20 years for superior performance organic coating finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers: Provide louvers meeting performance requirements by one of the following manufacturers:
   1. Air Flow Company, Inc; www.airflowco.net
   2. Airline Louvers: www.airlinelouvers.com/#sle.
   3. Airolite Company, LLC: www.airolite.com/#sle.
   4. American Warming and Ventilating: www.awv.com/#sle.
   5. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   6. Industrial Louvers, Inc: www.industriallouvers.com/#sle.

2.02 LOUVERS

A. General: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
   1. Wind Load Resistance: Design to resist positive and negative wind load of 20 psf without damage or permanent deformation.
   2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at 803 FPM intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
   3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
   4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: 4" Horizontal blade, extruded aluminum construction.
   1. Basis-of-Design: Model ELF 375X by Ruskin Mfg Co.
   2. Free Area: 50 percent, minimum.
   3. Static Pressure Loss: 0.22 inch wg maximum per square foot of free area at velocity of 1,000 fpm, when tested in accordance with AMCA 500-L.
   4. Blades: Straight.
   5. Frame: 4 inches deep, channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
   6. Aluminum Finish:
      a. Class I, clear anodized.
      b. Class I, color anodized.
      c. Superior performing organic coating.

C. Stationary Architectural Louvers: 2" Horizontal blade, extruded aluminum construction.
   1. Basis-of-Design: Model 2251 by Construction Specialties
   2. Blades: Drainable.
   3. Frame: 2 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
   4. Aluminum Thickness: Frame 16 gage, 0.052 inch minimum; blades 16 gage, 0.052 inch minimum.
   5. Aluminum Finish:
      a. Class I, clear anodized.
      b. Class I, color anodized.

c. Superior performing organic coating.

2.03 MATERIALS

A. Formed Aluminum: Formed sheet, ASTM B209 (ASTM B209M), 3003 or 5005 alloy, manufacturer's recommended temper for applications and finishes indicated.

2.04 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.
   1. Color: As selected by Architect/Engineer of Record from manufacturer's full range of colors.

C. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 0.9 mils.
   1. Color: As selected by Architect/Engineer of Record from manufacturer's full range of colors.

2.05 ACCESSORIES

A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1 inch thick, painted to match louver, including coating type, color and gloss; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; material as recommended by louver manufacturer, installed on inside face of louver frame.

C. Bird Screen: Interwoven wire mesh of aluminum, 14 gage, 0.0641 inch diameter wire, 1/2 inch open weave, square design.

D. Fasteners and Anchors: Stainless steel.

E. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

F. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Set sill members and sill flashing in continuous bead of sealant.

D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

E. Secure louver frames in openings with concealed fasteners.
F. Coordinate with installation of mechanical ductwork.

3.03 CLEANING

A. Strip protective finish coverings.
B. Clean surfaces and components.

END OF SECTION 08 91 00

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in contract documents that are receiving new floor coverings, including epoxy flooring.

B. Preparation of new and existing concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).

D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.

E. Remedial floor coatings.

1.02 DEFINITIONS

A. MVE: Moisture Vapor Emission.

1.03 REFERENCE STANDARDS

A. ASTM D7234 - Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers; 2012.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

C. ASTM F3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2013.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2017.

E. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.04 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Adhesive Bond and Compatibility Test Report.

C. Remedial Materials (MVE-Control System) Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
   3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.

4. Manufacturer's installation instructions.

D. Installer Qualifications: per quality assurance article.

E. Field Testing results per Execution article.

1.05 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Remedial Coating (MVE Control) Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

C. Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
   1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F and not more than 85 deg F at least 48 hours before use.
   2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F or more than 85 deg F and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
   3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

1.08 WARRANTY

A. Provide 10 year manufacturer warranty for MVE Control System. Manufacturer agrees to repair or replace MVE Control System that fails in materials within specified warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Remedial Floor Coating (MVE-Control System): Fluid applied, two component, 100% solids epoxy resin, membrane forming system intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. ASTM F3010
   2. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   3. VOC Content Limits: As specified in Section 01 61 16.
   4. Performance Requirements:
      a. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
         1) Relative Humidity: Maximum 100 percent when tested according to ASTM F2170 using in situ probes.
      b. Water-Vapor Transmission: Through MVE-control system, maximum 0.10 perm when tested according to ASTM E96/E96M.
   5. Products:
      a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
      b. LATICRETE International, Inc; LATICRETE DRYTEK Moisture Vapor Barrier with LATICRETE DRYTEK Skimcoat: www.laticrete.com/#sle.
      c. MAPEI; Planiseal VS
      d. Stauf USA, LLC; ERP-270 Perma-Seal: www.staufusa.com/#sle.
      e. UZIN, a division of UFLOOR Systems Inc; UZIN PE 460 with UZIN PE 280 and UZIN NC 170 LevelStar: www.ufloorsystems.com/#sle.

2.02 ACCESSORIES

A. Crack-Filling Material for static non-moving joints:
   1. Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.

B. Crack-Filling Material for dynamic movement joints:
   1. Self-leveling elastomeric polyurethane sealant recommended in writing by MVE-control system manufacturer for sealing moving expansion joints.

C. Bond Promoting Primer:
   1. Bond promoting primer recommended in writing by MVE-control system manufacturer for improving adhesion.

D. Cementitious Self-Leveling Underlayment:
   1. Self-leveling underlayment recommended in writing by MVE-control system manufacturer to meet floor flatness requirements.
   2. If leveling is not needed, provide cement-based high-performance, fiber-reinforced skimcoating compound recommended in writing by MVE-control system manufacturer.

PART 3 - EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Preliminary cleaning.

2. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
3. Specified remediation, if required.
4. Patching, smoothing, and leveling, as required.
5. Other preparation specified.
6. Adhesive bond and compatibility test.
7. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: Apply remedial floor coating (MVE-Control System) over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; otherwise, apply a skim coat of specified underlayment over entire suspect floor area.

3.02 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.03 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
1. Pre-filling static thin random drying shrinkage cracks (less than 0.01 inch width and not vertically displaced) is not required.
2. Fill static cracks (narrower than 1/8 inch and not vertically displaced) with MVE resin-based crack-filling material.

D. Do not fill expansion joints, isolation joints, or other moving joints.

E. Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.

1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
2. Provide concrete surface profile complying with ICRI 310.2R CSP2 or CSP 3 as recommended in writing by MVE-control system manufacturer.
3. Repair damaged and deteriorated concrete in accordance with the concrete surface repairs requirements of 03 30 00 - Cast-in-Place Concrete.
4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
5. Fill surface depressions and irregularities with patching and leveling material.
6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
7. Do not skim coat entire concrete slab prior to application of MVE-control system.
8. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
9. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.

F. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.04 ADHESIVE BOND AND COMPATIBILITY TESTING

A. For typical locations indicated to receive installation of MVE-Control system, install minimum 100-sq. ft. area of MVE-control system to prepared concrete substrate and test according to ASTM D7234.

B. Proceed with installation only where tensile bond strength is greater than 200 psi with failure in the concrete.

3.05 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer and ASTM F3010.

B. Apply system in thickness recommended in writing by MVE-control system manufacturer as indicated by preinstallation testing.

C. Cure MVE-control system according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

D. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

E. Apply bond promoting primer to epoxy MVE control system and allow primer to dry completely.

F. Install cementitious underlayment or skimcoating compound according to manufacturer’s written instructions.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Testing Agency: Engage a qualified testing agency to perform installation inspections.

C. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.
   1. Verify that surface preparation meets requirements.
   2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
   3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

3.07 PROTECTION

A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.

B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 09 05 61

SECTION 09 97 24
FLUID-APPLIED EPOXY FLOORING SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base at toilet rooms.
B. Divider strips, termination strips and accessories.
C. Coordination with wainscot products identified in Section 09 96 02 “High Performance Coatings Over Structural Glazed Tile”.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
C. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

1.03 SUBMITTALS

A. See Book 2 for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
C. Samples: Initial submission for color selection; submit 3”x3” samples of manufacturer’s full range of colors for initial selection.
    1. Include 12 inch lengths of each type of divider strip required for each type of resinous flooring.
D. Samples (aggregate level): Submit 12 by 12 inch in sized samples of initial color selected prepared with the full range of different aggregate / slip-resistance available for purposes of Owner review and approval. Selected aggregate / slip-resistance will form the basis for a field mock-up prior to full installation.
E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 10 years documented experience, with not less than 5 similar projects that have been in successful use for not less than 5 years. Manufacturer shall have the capacity to produce the quantities required without causing delays.
B. Source Limitations: Obtain primary resinous coating materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials. Manufacturer utilized for work under this Section shall be the same as used for Section 09 96 02 “High Performance Coatings Over Structural Glazed Tile”.

C. Applicator Qualifications: Company specializing in performing the work of this section.
   1. Minimum three years of documented experience similar in type and size to that of this project with a minimum of three similar resinous flooring applications.
   2. Approved by manufacturer.

1.05 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.
B. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture, slip-resistance and workmanship.
   1. Use same materials and methods for use in the work.
   2. Use approved design samples as basis for mock-ups.
   3. Locate where directed.
   4. Minimum Size: 100 square feet.
C. Obtain approval of mock-up by Architect/Engineer of Record before proceeding with work.
   1. Contractor shall modify aggregate / slip-resistance in the mock-up, if requested by Ownership, until mock-up is approved.
D. Approved mock-up may remain as part of the work and shall provide the basis for subsequent installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.
B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 65 degrees F.
B. Store materials in area of installation for minimum period of 24 hours prior to installation.
C. Maintain ambient temperature of 65-degrees F or as required by manufacturer (whichever is higher) 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 FLUID-APPLIED FLOORING SYSTEMS

A. Single Source Responsibility: Obtain primary flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than 5 years of successful experience in supplying principal materials for work of type required. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.
B. Fluid-Applied Flooring at Toilet Rooms: Broadcast epoxy: Manufacturer's standard decorative-type floor surfacing system consisting of primer; topping including epoxy resin, hardener and broadcast ceramic-coated quartz aggregate; and finish coats. System thickness of 1/8” with 6” cove to match field color. Provide only factory-supplied and packaged materials including aggregate for all components of floor surfacing system.
   1. Products:

a. Crossfield Products: Decor-Flor: www.crossfieldproducts.com
   1) Includes Manufacturer's clear polyurethane sealer / two – component top-coat,
b. Sherwin-Williams Company: Resuflor Deco Quartz BC 23: www.sherwin-williams.com
   1) Includes Manufacturer's clear polyurethane sealer / top coat,
c. Stonhard: Stonshield SLT: www.stonhard.com
   1) Includes Manufacturer's clear polyurethane sealer / top coat, Stonseal SK6

2. Cove Base Products:
   a. Crossfield Products: Cove Base Gel: www.crossfieldproducts.com
   b. Sherwin-Williams Company: Epoxy Cove Base: www.sherwin-williams.com
   c. Stonhard: Epoxy Cove: www.stonhard.com

2.02 ACCESSORIES

A. Divider Strips: Stainless steel, height to match flooring thickness, with anchoring features.
B. Cove Base Termination Bar at top of flooring system coved base (where no ceramic tile occurs). White metal, thickness to match flooring thickness with anchoring features.
C. Base Caps: Match divider strips with projecting base of 1/8 inch; color as selected.
D. Cant Strips: Molded of flooring resin material.
E. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
F. Primer: Waterproof, type recommended by fluid-applied flooring manufacturer.
G. For Use at Polyurethane Floor System:
   1. Urethane Epoxy Flexible Joint Filler.
   2. Sealant: Provide urethane based sealant to fill moving cracks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring. All deleterious, loose or un-bonded materials shall be removed to the satisfaction of epoxy flooring system manufacturer.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): range of 5 to 9 when tested according to ASTM F710, unless otherwise required by flooring manufacturer.
      b. Moisture Vapor Emission: Not greater than 3 lb per 1000 sq ft per 24 hours, tested according to ASTM F1869, unless otherwise required by flooring manufacturer.
   2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
E. Verify that required floor-mounted utilities are in correct location.

F. Verify that required ambient and surface temperature and humidity are within the manufacturer's recommended range.
G. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
B. Remove any loose or deleterious materials from the substrate surface to the satisfaction of the epoxy floor system manufacturer.
C. Prepare concrete surfaces according to ICRI 310.2R, CSP 4, unless otherwise recommended by fluid applied flooring system manufacturer for applications indicated.
D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
E. Vacuum clean substrate.
F. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

A. Accurately saw cut substrate to install divider strips.
B. Install strips straight and level to locations indicated.
C. Install cant strips at base of walls where flooring is to be extended up wall as base.
D. Install terminating cap strip at top of base; attach securely to wall substrate.
E. Install base divider strips to match floor pattern.
F. Install Cove Base Termination Bar at top of flooring system coved base (where no ceramic tile occurs), thickness to match flooring thickness, with anchoring features. Install sealant at all wall-to-termination bar gaps, refer to Section 07 92 00 "Joint Sealants" for additional information, color to match wall finish.

3.04 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.
B. Apply each coat to minimum thickness required by manufacturer.
C. Finish to smooth level surface.
D. Cove at vertical surfaces.
E. Install manufacturer's clear protective coats.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.
B. Barricade area to protect flooring until fully cured.

END OF SECTION 09 67 00

SECTION 09 91 03

SURFACE PREPARATION FOR RENOVATION PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cleaning, paint removal, and surface preparation of existing exposed interior and exterior items and surfaces in preparation for finish painting.

1.02 REFERENCES

A. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.

B. SSPC-SP 11 - Power Tool Cleaning to Bare Metal; 2012 (Ed. 2013).

C. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

D. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

1.03 RELATED SECTIONS

A. Section 09 91 05 - Renovation Painting

B. Section 09 91 23 - Interior Painting
   1. Substrate testing requirements

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
   3. Require attendance by all affected installers including but not limited to
      a. Contractor's Superintendent
      b. Installer
      c. Manufacturer/Fabricator Representative
      d. Other affected Subcontractors
      e. Architect
      f. Owner’s Representative
   4. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect, Owner’s Representative and those affected by decisions made.

1.05 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data: Provide product data for each product specified, including patching materials, cleaning solutions, and chemical stripper materials. Submit data for equivalent products in lieu of specified products, if specified products are not preferred.

1.06 MOCK-UP

A. On existing surfaces using applicable specified methods of cleaning and surface preparation, prepare mockup surface on at least 100 sq. ft. of surface for each of the conditions that apply to the project indicated in the table in of this section.

1.07 QUALITY ASSURANCE

A. The contractor shall not proceed with surface preparation work until the Architect has observed the Contractor's protection measures as specified in Section 09 91 05 – Renovation Painting.

PART 2 - PRODUCTS

2.01 CHEMICAL REMOVAL MATERIALS

A. Cleaning Solutions: Mild Detergent: Degreasing cleansing agent commercially available such as "TSP Substitute, Heavy Duty Cleaner", manufactured by Bondex International. Other products manufactured by other manufacturers may be used provided they can be shown to perform equally to the specified product. TSP shall not be used. Cleaning solutions shall not leave residue on surface to be painted. Use detergent in Solution recommended by detergent manufacturer.

B. Solvents shall be used to remove oil, grease, tar, smoke and asphalt from designated surfaces. Solvents must not be flammable and cannot contain any carcinogens or OSHA regulated substances (per 29 CFR 1910.100-1053).

C. Chemical Removal: Chemical removers shall not be flammable nor contain methylene chloride carcinogens or any other OSHA regulated substance (per 29 CFR 1910.1001-1052). Remover shall remove all paint from substrate, leave no residue and require minimal additional surface preparation.

D. Sheet Metal Paint Stripper: Prosoco, Incorporated, "Sure-Klean T1375" paint stripper specifically designed to remove coatings from metal surfaces and recommended for use for applications indicated for this project. Other products manufactured by other manufacturers may be used provided they can be shown to perform equally to the specified product.

2.02 TOOLS AND EQUIPMENT FOR PAINT REMOVAL

A. Power tools include rotary wire brushed, cup brushes, power sanders, power grinding or power brushing tools. Portable power tools shall be used with filter vacuum attachments.

B. Wet Sanding and Wet Scraping: Whenever sanding materials and scrapers are used, use wet methods. Use misters to dampen the surface before sanding or scraping. Use water mist for wet sanding. (Exception: Chemical removal methods.)

2.03 MISCELLANEOUS MATERIALS

A. Interior Patching Compound Materials: Provide cementitious patching compounds and repair materials specifically manufactured for surface preparation prior to repainting. Provide materials manufactured by one of the following:
   1. Bondex International.
   2. Dap, Incorporated.
   3. Tuff Cote Company.
   4. 3M Corporation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 PROTECTION

A. Protect surrounding areas and adjacent surfaces to prevent damage or spattering of paint during painting work. Correct damage to affected surfaces by cleaning, repairing or replacing, and repainting.

B. As work proceeds, promptly remove spilled or splattered paint materials by methods that do not damage surfaces. During progress of work keep premises free from unnecessary accumulation of tools, equipment, surplus materials, debris, and the like.

C. Provide drop cloths, shields, and protective equipment as required to protect all existing surfaces not within painting scope of work.

D. Cover all air vents and registers with 6 mil polyethylene sheet taped to prevent dust from entering ventilation system. After removal of polyethylene sheet protection, prepare and refinish covered surfaces. Use tapes that do not leave adhesive marks or residue on applied surfaces.

E. Furniture and equipment in existing rooms shall be covered. Cover equipment and furniture with 6 mil polyethylene sheet taped and sealed to the floor to prevent dust from contaminating furniture and equipment.

F. Cover carpeting with 6 mil polyethylene sheet taped and sealed airtight to prevent dust from contaminating carpet.

G. Maintain coverings during progress of work; immediately repair openings that occur in coverings and reseal tape that loses adhesion.

H. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixture escutcheon plates, and similar items in place that are not to be painted and reinstall after completion of work. Provide surface-applied protection to items that cannot be removed prior to surface preparation and painting. Following completion of painting operations in each space or area, have reinstall items and remove surface-applied protection.

I. No dust or odors may leave the work area. Construct critical barriers and seal off openings and penetrations into the work areas, including doorways and windows. Use polyethylene plastic sheeting on wood studs if necessary; lap and tape joints of sheeting to prevent dust, particles and fumes from leaving the enclosed areas.

3.03 SURFACE PREPARATION, GENERAL REQUIREMENTS

A. Clean and prepare surfaces to be painted according to these specifications and manufacturer's instructions for each particular substrate condition.
   1. Provide barrier coats over incompatible previously painted surfaces or primers or remove coats and re-prime. Notify Architect in writing about anticipated problems using the specified finish-coat material over substrates previously finished.

B. Existing Paint Film in Good Condition, Including Tightly Adhered Paint Film: Wash areas to be repainted; use mild detergent solution, and then rinse with clean water until all detergent has been removed. Remove dirt and chalk from the surface without damaging the substrates or adjacent areas. Washed areas shall be permitted to dry thoroughly before painting is started.

C. Cracked or Broken Paint Film, but Field and Test Areas Tightly Adhered: The areas to be painted shall be treated as per "Existing Paint Film in Good Condition, Including Tightly Adhered Paint Film" above. After washing, the areas shall be carefully examined for cracking, blistering, peeling or flaking paint. All loose, unsound, non-adhering paint shall be removed from such areas. Thick edges (multiple coats of remaining old paint) shall be scraped to smooth the edges. The surface shall then be wiped clean to remove remaining dust that would prevent paint adhesion.

D. Loose, Flaking, or Peeling Paint Film: Remove old paint film down to bare substrate by using one, or a combination of the following methods:
   1. Hand tool removal, scraping and wet sanding
   2. Power tool cleaning using low-dust emission methods
   3. Chemical Removal

E. The selection of the specific means and methods of surface preparation system shall be the responsibility of the Painting Contractor, provided surface preparation is within the appropriate code classification as indicated in an Adhesion Test Report.

F. The Drawings show the extent of the areas to be painted. The following table describes the minimum cleaning and removal methods required for existing condition of surface to be prepared for repainting:

EXISTING SURFACE CONDITION	CLEANING AND REMOVAL
EXISTING PAINT FILM IN GOOD CONDITION; TIGHTLY ADHERED.	**DETERGENT WASH WITH SPECIFIED CLEANING METHODS. PREPARE CLEANED SURFACE TO BE REPAINTED IN ACCORDANCE WITH SPECIFIED SURFACE PREPARATION METHODS.**
CRACKED OR BROKEN PAINT FILM, BUT FIELD AREAS AND TEST AREAS ARE TIGHTLY ADHERING.	**OPEN CRACKS. SCRAPE BY HAND TOOL CLEANING METHODS TO REMOVE ALL LOOSE PAINT FILM, UNTIL ONLY TIGHTLY ADHERED FILM REMAINS. PATCH AND WET SAND AS NEEDED TO ACHIEVE A SMOOTH UNIFORM SURFACE. WET SAND ALL SURFACES. SURFACE SHALL BE DETERGENT WASHED PRIOR TO REPAINTING. PREPARE CLEANED SURFACE TO BE REPAINTED IN ACCORDANCE WITH SPECIFIED SURFACE PREPARATION METHODS. PATCH AND WET SAND AS NEEDED TO ACHIEVE A SMOOTH UNIFORM SURFACE.**
LOOSE, FLAKING, OR PEELING PAINT FILM AND WALLS EXHIBITING ADHESION TEST RESULTS OF 3A OR 2A.	**REMOVE LOOSE, FLAKING OR PEELING PAINT FILM BY HAND CLEANING, POWER TOOL CLEANING, OR CHEMICAL CLEANING METHODS. SURFACE SHALL BE DETERGENT WASHED. PREPARE CLEANED SURFACE TO BE REPAINTED IN ACCORDANCE WITH SPECIFIED SURFACE PREPARATION METHODS. PATCH AND SAND AS NEEDED TO ACHIEVE A SMOOTH UNIFORM SURFACE.**

PAINTED SURFACES INDICATED TO HAVE PAINT COMPLETELY REMOVED AND WALLS EXHIBITING ADHESION TEST RESULTS OF 1A OR 0A.	**REMOVE PAINT FILM BY HAND CLEANING, POWER TOOL CLEANING, OR CHEMICAL CLEANING METHODS. SURFACE SHALL BE DETERGENT WASHED PRIOR TO REPAINTING. PREPARE CLEANED SURFACE TO BE REPAINTED IN ACCORDANCE WITH SPECIFIED SURFACE PREPARATION METHODS. PATCH AND SAND AS NEEDED TO ACHIEVE A SMOOTH UNIFORM SURFACE.**
MISSING MATERIAL, SUCH AS SMALL HOLES, OPENINGS OR DETERIORATED OR CORRODED SUBSTRATE.	**REFER TO REPLACEMENT SECTIONS FOR REQUIREMENTS FOR CUTTING AND REPLACEMENT PATCHING OF MISSING MATERIAL. AFTER PATCHING, REFINISH NEW SURFACE COMPLYING WITH SURFACE PREPARATION AND PAINTING SPECIFIED FOR NEW CONSTRUCTION.**
EXISTING PLASTER SUBSTRATES.	**TEST FOR PRESENCE OF CALCIMINE COATING AND/OR LACK OF ADHESION OF EXISTING LAYERS OF PREVIOUSLY APPLIED PAINT MATERIALS. WHERE TEST RESULTS ARE POSITIVE, PREPARE SUBSTRATES, INCLUDING REMOVAL OF EXISTING LAYERS OF PREVIOUSLY APPLIED PAINT MATERIALS AS REQUIRED OR RECOMMENDED BY PAINT MANUFACTURER TO PROVIDE SOUND SUBSTRATES, SUITABLE AND ACCEPTABLE TO PAINT MANUFACTURER FOR APPLICATION OF PRODUCTS.**

3.04 SURFACE PREPARATION METHODS

A. Cleaning Systems: Use the following cleaning methods, using the mildest method necessary to clean the surface.

B. Washing, Hand-Cleaning: This system shall be employed on sound tightly adhered surfaces. It may be used to remove chalking, blistering, cracking, flaking and peeling paint, dust, dirt, loose rust and other foreign matter.
   1. Use specified detergent solution. The washed area shall then be rinsed with clear water until it is clean. Replace water after each application. Repeat the rinsing process until the surface does not exhibit any evidence of chalking, dust, dirt, or other foreign matter after it has dried. The washed areas shall be allowed to dry thoroughly before painting is started. Painting should not proceed until moisture content is as specified as determined by an electronic moisture meter.

C. Hand Cleaning - Allowable Tools: Use wet sanding and wet scraping methods only. Lightly mist substrate before sanding or scraping. Acceptable hand-tools include scrapers, wire brushes, sandpaper, steel wool, non-metallic pads, and dusters. Painting Contractor is responsible for selecting the appropriate tools from those listed above based on each substrate condition encountered in the scope of work. After hand-cleaning is attempted, power tool cleaning may be required to complete cleaning and preparation of the surface.

D. Chemical Cleaning - Solvents: Solvent cleaning may be used to clean off oil, grease, smoke, tar and asphalt from painted or unpainted surfaces before preparation work begins. In addition, if necessary, spot-solvent-cleaning may be employed just prior to the commencement of paint application, provided sufficient time is allowed for complete evaporation. The method to be used (wiping, scraping, scrubbing with pads or brushes) shall be selected by the Painting Contractor. Clean solvent and clean rags shall be used for the final wash to ensure that all of the foreign materials shall be removed.

E. Power Tool Cleaning: Equipment shall be used with vacuum filter attachments. The substrate to be cleaned and its existing condition will dictate the specific tools to be employed. Painting contractor may use a combination of tools and one or more of the systems available.

3.05 PAINT REMOVAL METHODS

A. Removal Methods: The chemical removal procedure shall be used where cleaning methods have been attempted and further removal of the paint is required due to incompatible or unsatisfactory surfaces for repainting. In addition, use complete removal methods for items indicated or specified to have existing paint completely removed.

B. Items to have complete paint removal include, but are not limited to:
   1. Steel Sash Windows
   2. Sheet metal Window Trim

C. Chemical Removal: Chemical removal systems may be employed to remove part or complete coatings of paint. Follow manufacturer's instructions for application, removal and rinsing

3.06 SURFACE PREPARATION: EXISTING PAINTED WOOD

A. Repair damaged wood areas, including dents, holes, and cracks, by filling with patching compound and wet sand smooth. Reset or remove protruding nail heads.

B. Clean as required to remove existing deteriorated coatings and any foreign matter. Thick build-up of paint and runs and sags shall be wet sanded to achieve a smooth edge.

C. Clean wood surfaces of dirt, oil, and other foreign substances with scrapers, appropriate cleaners, and sandpaper.

3.07 SURFACE PREPARATION: EXISTING PAINTED CEMENTITIOUS MATERIALS

A. Cementitious Materials: Includes concrete, brick masonry, concrete masonry, and similar materials.

B. Prepare concrete, concrete masonry block, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents.
   1. Alkalinity and moisture content testing is specified in Section 09 91 23 - Interior Painting. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application of paint. Do not paint surfaces where moisture content exceeds that permitted by these specifications.

C. Concrete Floors: Clean to the extent required to remove existing deteriorated coatings. Remove efflorescence, reporting recurrence if caused by structural defect. If there is no recurrence of efflorescence, the bare spots shall be acid-washed (mild etcher) to neutralize surface alkalinity and rinsed with clean water prior to application of any coatings.
   1. Where there is no evidence of efflorescence, scrub with the mild detergent solution. Remove dirt and all other foreign matter. Oil and grease will require removal by solvent cleaning.

3.08 SURFACE PREPARATION: EXISTING PLASTER, GYPSUM BOARD

A. New and Bare Plaster: Neutralize surface of plaster with mild acid solution as recommended by paint manufacturer. In lieu of acid neutralization, provide manufacturer's recommendation for plaster primer over alkaline plaster surfaces.

B. Sound Existing Paint System: Wash all areas to be painted; use a mild detergent solution, and then rinse with clean water until all detergent has been removed. Remove dirt and chalk from the surface without damaging the substrates or adjacent areas. Washed areas shall be permitted to dry thoroughly before painting is started. (Before painting, moisture content must

not exceed as specified in Section 09 91 23 - Interior Painting as determined by an electric moisture meter.)

C. Surface cracks shall be routed out to remove loose, unsound material and filled with patching compound, wet sanded and spot-primed with specified primer.

D. Patch all surfaces as needed with manufacturer approved patching compound to achieve a smooth uniform surface. Wet sand, and allow to dry.

3.09 SURFACE PREPARATION: EXISTING BARE AND PAINTED METAL

A. Bare Metal Solvent Cleaning: Solvent clean to remove oils, greases and other contaminants before other treatments are used. Do not use solvents that leave residue such as primer thinner or turpentine.

B. Ferrous Metals: Clean ungalvanized ferrous metal surfaces; remove rust, oil, grease, dirt, and other foreign substances. Use removal or cleaning methods that comply with recommendations of paint manufacturer.
   1. Touch up bare areas and prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

C. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is free of oil and surface contaminants.

D. Metal Conditioner (Apply to bare metal): Phosphoric acid based, etching type, surface treatments applied after solvent cleaning. Apply according to manufacturers' instructions. Rinse with clear water when reaction is complete. Allow at least 15 to 30 minutes, but not less than recommended by manufacturer. Do not allow conditioner to dry before rinsing. If white rust (zinc oxide) appears after drying, wash clean with denatured alcohol immediately before priming.

E. Surface Preparation Methods: Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
   1. SSPC-SP 2
   2. SSPC-SP 3
   3. SSPC-SP 11

F. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply 2 coats of shop paint to inaccessible surfaces.

END OF SECTION 09 91 03

SECTION 09 91 05

RENOVATION PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements for renovation painting of existing interior and exterior items and surfaces.

1.02 REFERENCES

A. ASTM D3359 - Standard Test Method for Rating Adhesion by Tape Test; 2017.

B. ASTM D6677 - Standard Test Method for Evaluating Adhesion by Knife; 2007.

C. NFPA 10 - Standard for Portable Fire Extinguishers; 2017.

D. PDCA P5 - Benchmark Sample Procedures for Paint and Other Decorative Coating Systems; Current Edition.

1.03 RELATED SECTIONS

A. Section 09 91 03 - Surface Preparation for Renovation Painting

B. Section 09 91 23 - Interior Painting
   1. Interior paint finish system products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
   3. Require attendance by all affected installers including but not limited to
      a. Contractor's Superintendent
      b. Installer
      c. Manufacturer/Fabricator Representative
      d. Other affected Subcontractors
      e. Architect
      f. Owner’s Representative
   4. Review the Benchmark Sample for the following:
      a. Surface Preparation.
      b. Coverage rates.
      c. Color.
      d. Sheen uniformity.
      e. Pinholing.
      f. Application techniques.
   5. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect, Owner’s Representative and those affected by decisions made.

1.05 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data, Samples, Warranty Documentation, and Maintenance Materials: Refer to requirements in Section 09 91 23 – Interior Painting.

C. Warranty Documentation: Provide a letter of "intent to warranty," including manufacturer warranty and ensuring that forms have been completed in Owner's name and registered with manufacturer for length of term indicated in warranty paragraphs below.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 – Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color and finish paint installed, of each color; from the same product run, store where directed.
   3. Label each container with color and room names or numbers where paint was used without obscuring manufacturer's label.
   4. Deliver materials to the location designated by the Architect or Owner’s Representative.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years documented experience and written approval by manufacturer.

1.07 BENCHMARK MOCK-UP

A. Provide benchmark mock-up of each type of coating on each substrate required, 10 feet long by 10 feet wide, illustrating coating, color, and surface sheen, for each specified coating. Comply with procedures in PDCA P5 Benchmark Sample Procedures. Duplicate finish of approved sample submittals.

B. Locate where directed.

C. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
   1. After finishes are accepted, the Architect will use the room to evaluate coating systems of a similar nature.

D. Approved benchmark mockups will be used to evaluate coating systems.

E. Obtain Architect’s approval of benchmark mockups before starting application of coatings.

F. Final approval of colors will be from benchmark mockups.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

E. Fire Protection: Furnish fire protection, including, but not limited to, portable fire extinguishers, on site as required by authorities having jurisdiction. Comply with NFPA 10 for selection, distribution, and use of units. In addition, furnish fire protection equipment at locations where heat removal methods are used.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Do not install painting until permanent lighting systems has been installed and is operational.

E. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

1.10 INSPECTIONS

A. Contractor shall perform inspections at project site including the following:
   1. Inspect materials delivered to site to verify specified products are delivered and in undamaged and unopened conditions
   2. Inspect required protections to ensure dust/odors will not spread beyond work area.
   3. Verify temporary facilities are in place such as lighting, protections, etc.
   4. Inspect surface conditions prior to finish painting to ensure that surface preparation in complete.

1.11 WARRANTY

A. Warranty: Submit a written warranty, executed by the painting contractor and manufacturer, agreeing to repair or refinish surfaces that fail in materials or workmanship within the specified warranty period. Warranty shall include, but be not limited to:
   1. Warranty period for defective materials: 2 years after the date of Substantial Completion, unless paint manufacturer provides a longer warranty term for materials.
   2. Warranty period for defects in new paint film: Including defects such as blistering, chalking, checking, cracking, erosion, flaking, adhesion loss; 2 years after date of Substantial Completion.

B. The warranty shall not deprive the Owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints: As specified in Section 09 91 23 – Interior Painting.

2.02 MATERIALS, GENERAL REQUIREMENTS

A. Material Compatibility: Furnish block fillers, primers, finish coat materials, and related materials specified elsewhere that are compatible with one another and with the existing painted substrates, as demonstrated by the manufacturer, based on testing or field experience.

B. Patching Material Compatibility: Furnish surface preparation products, including patching compounds, that are compatible with selected paint products as specified in Section 09 91 03 – Surface Preparation for Renovation Painting.

2.03 PAINTING SYSTEMS

A. Refer to products specified in Section 09 91 03 – Surface Preparation for Renovation Painting.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with paint application requirements. Comply with the specifications and manufacturer's requirements for condition of surfaces.
   1. Conform with manufacturer's requirements for warranty to be furnished by the manufacturer.
   2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Do not begin to apply paint until unsatisfactory conditions have been corrected.

C. Surface preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

D. Coordination of Work: Review Sections in which primers are specified to ensure compatibility of the total system for various substrates.
   1. Notify the Architect and Owner’s Representative, a minimum of one working day prior to painting, about anticipated problems using the specified materials over substrates previously finished with incompatible materials.

E. Conduct alkali testing with litmus paper on exposed plaster, exposed cementitious and masonry surfaces, and do not begin painting if surfaces exceed alkalinity allowed by the paint manufacturer.

F. Test moisture content of surfaces using an electronic moisture meter. Do not begin application of coatings unless moisture content of exposed surfaces (either new or bare), including fillers and patching materials, is below the following maximum values:
   1. Gypsum wallboard: 12 percent.
   2. Plaster: 12 percent.

3. Masonry surfaces: 12 percent.
4. Finish woodwork: 7%-10% moisture content
5. Wood surfaces: 15 percent.
6. Vertical concrete surfaces: 12 percent.
7. Horizontal concrete surfaces: 8 percent.

G. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 APPLICATION

A. Conform to manufacturers' requirements for application methods and to Section 09 91 13 – Exterior Painting and Section 09 91 23 – Interior Painting. Apply paint by methods to achieve approved sample and mockup finishes.

B. When painting new substrates patched into existing surfaces, Furnish finishes specified for the specific substrate. Final finish coat shall be applied over the entire surface from border to border.

C. All existing glossy painted surfaces shall be washed thoroughly with a tri-sodium phosphate solution. Rinse, and allow to dry thoroughly.

D. All surfaces to be painted must be prepared in accordance with the provisions of Section 09 91 03 – Surface Preparation for Renovation Painting.

3.03 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke test procedures at any time and as often as the Owner deems necessary during the period when paint is being applied and at any time prior to Substantial Completion.

B. The Owner may engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project may be taken, identified, sealed, and certified in the presence of the Contractor.

C. The testing agency will perform on site and laboratory tests for the following characteristics as required by the Owner:
1. ASTM D3359 and ASTM D6677 Adhesion Tests.
2. Film thickness tests.
3. Quantitative materials analysis.
4. Apparent reflectivity.
5. Washability.
6. Dry opacity.

D. If test results show material being used does not comply with specified requirements, the Contractor may be directed to do the following (one or more in combination):
1. Stop painting
2. Remove paint that does not comply with specified requirements.
3. Pay for retesting
4. Repaint rejected surfaces
5. Remove rejected paint from previously painted surfaces.

E. After completion of work clean area and surfaces of all dust and debris.

3.04 CLEANING

A. Daily Cleanup: At the end of each work day, remove empty cans, rags, cleaning pads, rubbish, and other discarded paint materials from the site.

B. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces or to generate dust.

C. Final Cleanup: After completing painting, area shall be thoroughly cleaned to remove all dust and spattered paint and patching materials. All surfaces shall be washed clean to remove all dust and dirt, including dust and dirt that existed prior to painting. All Surfaces to be cleaned include every exposed surface in the space such as, walls, floors, ceilings, ledges, sills, soffits, surfaces of fixed equipment and accessories, conduits, wires, ducts, etc. Movable furniture and furnishings are required to be sealed in plastic sheeting prior to start of work. In the event of failures of polyethylene sheet, clean covered furniture and furnishings to remove dust.

END OF SECTION 09 91 05

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.
   2. Metal steel sash windows
   3. Metal steel sash window surround trim
   4. Mechanical and Electrical:
      a. On the roof and outdoors, paint equipment that is exposed to weather or to view, excluding factory-finished materials.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, chrome plated, bronze, terne coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Brick, glass unit masonry, architectural concrete, limestone, natural stone, cast stone, integrally colored plaster and stucco.
   11. Glass.
   12. Concrete masonry units in utility, mechanical, and electrical spaces.
   13. Concealed pipes, ducts, and conduits.
   14. Concealed wall and ceilings surfaced in inaccessible spaces.
   15. Architectural woodwork.
   16. Metal lockers.
   17. Elevator equipment.

E. Refer to Section 09 91 03 - Surface Preparation for Renovation Painting for procedures related to preparation of existing surfaces and substrates indicated to receive coatings.

1.02 RELATED SECTIONS

A. Section 09 91 03 – Surface Preparation for Renovation Painting

B. Section 09 91 05 – Renovation Painting

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

B. Gloss ranges used in this Section include the following:
   1. Flat refers to a lusterless or matte finish with a gloss range below 5 when measured at a 60-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 5 and 10 when measured at a 60-degree meter.
   3. Satin refers to low-sheen finish with a gloss range between 10 and 35 when measured at a 60-degree meter.
   4. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

C. Concealed: Refers to surfaces, materials, assemblies, or items that cannot be accessed without moving a building element, such as within a chase, wall, or ceiling cavity.

D. Exposed: Refers to any item or surface that is not concealed.
   1. Exposed to Public View: Refers to items situated so they can be seen from eye level from a public location. A public location is that which is accessible to persons not responsible for operation or maintenance of the building.

1.04 REFERENCE STANDARDS

A. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. ASTM D3359 - Standard Test Method for Rating Adhesion by Tape Test; 2017.

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2016.

E. ASTM D6677 - Standard Test Method for Evaluating Adhesion by Knife; 2007.

F. PDCA P1 - Touch Up Painting and Damage Repair: Financial Responsibility and Definition of a Properly Painted Surface; Current Edition.

G. PDCA P5 - Benchmark Sample Procedures for Paint and Other Decorative Coating Systems; Current Edition.

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

I. SSPC-SP 1 - Solvent Cleaning; 2015.

J. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

K. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

L. SSPC-SP 7 - Brush-Off Blast Cleaning; 2007.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
   3. Require attendance by all affected installers including but not limited to
      a. Contractor's Superintendent
      b. Installer
      c. Manufacturer/Fabricator Representative
      d. Other affected Subcontractors
      e. Architect
      f. Owner’s Representative
   4. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect, Owner’s Representative and those affected by decisions made.

1.06 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Initial Selection Samples: Submit manufacturer's color charts illustrating full range of available colors and textures for each type of product and finish required for the Project.
   1. Confirm availability of colors specified by Architect with the manufacturer and notify the Architect in writing if any discrepancies, including lack of availability, should occur

D. Verification Samples: Submit three "draw down" samples, 12 by 12 inches in size, illustrating range of colors available for each finishing product specified, prepared on hardboard.
   1. Each sample shall be labeled with the following:
      a. Project name and number.
      b. Date.
      c. Manufacturer's name.
      d. Installer's name.
      e. Product name.
      f. Product number.
      g. Color name and number as stated in the color schedule.
      h. Name, address, and phone number of the supplying facility.
   2. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
   3. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application (e.g. "classroom ceiling").

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 5% of the amount installed, but not less than 1 gallon of each color; from the same product run, store where directed.

3. Label each container with color and room names or numbers where paint was used without obscuring manufacturer's label.
4. Deliver materials to the location designated by the Owner’s Representative.

1.07 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years documented experience and approved by manufacturer.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.08 BENCHMARK MOCK-UP

A. Provide benchmark mock-up of each type of coating on each substrate required, 10 feet long by 10 feet wide, illustrating coating, color, and surface sheen, for each specified coating. Comply with procedures in PDCA P5. Duplicate finish of approved sample submittals.

B. Locate where directed.

C. Approved benchmark mockups will be used to evaluate coating systems.

D. Obtain Architect's approval of benchmark mockups before starting application of coatings.

E. Final approval of colors will be from benchmark mockups.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.10 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Sherwin-Williams Company (SW). SINGLE SOURCE PER FPDCC STDS.

C. Stains:
1. Sherwin-Williams Company (SW). SINGLE SOURCE PER FPDCC STDS.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
1. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect of Record.

2.03 PAINT SYSTEMS

A. Concrete Substrates, Nontraffic Surfaces:
1. Latex System MPI EXT 3.1A:
a. Prime Coat: Latex, exterior, matching topcoat.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

B. CMU Substrates:
1. Latex System:
a. Prime Coat: Block filler, latex, interior/exterior, applied at spreading rate recommended by the manufacturer to achieve a total dry mill thickness of not less than 4.0 mils.
[redacted]
3) S-W: Preprite Block Filler, B25W25.
[redacted]
b. Topcoat: Latex, exterior, semi-gloss, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils.
[redacted]

3) S-W: Pro Industrial Acrylic Semi-Gloss, B66-651 Series.

C. Steel and Iron Substrates:
1. Alkyd System:
a. Prime Coat: Primer, alkyd, anticorrosive, for metal, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

3) S-W: Kem Bond HS, B50 Series.

b. Topcoat: Alkyd, exterior, semi-gloss, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

3) S-W: Metalastic DTM, B55 Series.
4)

D. Galvanized-Metal Substrates:
1. Latex System:
a. Prime Coat: Primer, galvanized, water based, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

3) S-W: Pro Industrial ProCryl WB Metal Primer, B66-310 Series.

b. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

3) S-W: Pro Industrial Acrylic Semi-Gloss, B66-651 Series.

E. Wood Substrates: Wood trim, doors, windows, wood board siding, and wood fences.
1. Latex over Latex Primer System:
a. Prime Coat: Primer, latex for exterior wood, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

3) S-W: Exterior Latex Primer, B42W8041.

b. Topcoat: Latex, exterior, semi-gloss loss Level 5, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.

2)
3) S-W: Solo Semi-Gloss, A76-51 Series.
4)

F. Exterior Gypsum Board Substrates:
1. Latex System:
a. Prime Coat: Primer, latex for exterior wood.

[redacted]

3) S-W: Exterior Latex Wood Primer, B42W8041.

[redacted]

b. Topcoat: Latex, exterior, low sheen.

[redacted]

3) S-W: A-100 Acrylic Flat, A6 Series.

[redacted]

G. Precast Concrete Substrates:
1. Acrylic Latex System:
a. Primer: Products listed below are self-priming.
b. First and Second Finish Coats: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils.

[redacted]

3) S-W: Modur F (OTC) (390 g/l).

[redacted]

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished with the applicator present prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

E. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:
1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

G. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

H. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

I. Galvanized Surfaces:
1. Clean to remove soluble contaminants with solvent or water-based cleaner/degreaser according to SSPC-SP 1. If new deck, remove oil/passivator coating according to SSPC-SP 7
2. Remove rust according to SSPC-SP 3
3. Profile new galvanized surface with sweep- or brush-blasting to depth not exceeding 2.0-mils.
4. Galvanizing Repair Paint: Provide SSPC-Paint 20 with dry film containing 94-percent (min.) zinc dust by weight to repair damaged galvanized coating according to ASTM A780/A780M.

J. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

K. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. The Owner reserves the right to invoke the following field inspection test procedures at any time and as often as the Owner deems necessary during the period when paint is being applied:
   1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
   2. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove non-complying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.
   3. The testing agency will perform on site and laboratory tests for the following characteristics as required by the Owner:
      a. Adhesion Tests: ASTM D3359 and ASTM D6677.
      b. Film thickness tests.
      c. Quantitative materials analysis.
      d. Apparent reflectivity.
      e. Washability.
      f. Dry Capacity.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Daily Cleanup: At the end of each work day, remove empty cans, rags, cleaning pads, rubbish, and other discarded paint materials from the site.

C. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces or to generate dust.

D. Final Cleanup: After completing painting, area shall be thoroughly cleaned to remove all dust and spattered paint and patching materials. All surfaces shall be washed clean to remove all dust and dirt, including dust and dirt that existed prior to painting. All Surfaces to be cleaned include every exposed surface in the space such as, walls, floors, ceilings, ledges, sills, soffits, surfaces of fixed equipment and accessories, conduits, wires, ducts, etc. Movable furniture and furnishings are required to be sealed in plastic sheeting prior to start of work. In the event of failures of polyethylene sheet, clean covered furniture and furnishings to remove dust.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion. Comply with procedures specified in PDCA P1.

END OF SECTION 09 91 13

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation for new construction.

B. Field application of paints and stains.

C. Materials for backpriming woodwork.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment. Paint back of panels prior to installation panels on wall.
   2. Surfaces inside cabinets.
   3. Prime paint surfaces to receive wall coverings.
   4. Previously painted terrazzo wall base, where exposed to view.
   5. Mechanical and Electrical:
      a. In finished areas and where exposed to view, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes, unless prime painting is required.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, chrome plated, bronze, terne coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   10. Glass.
   11. Concrete masonry units in utility, mechanical, and electrical spaces.
   12. Acoustical materials, unless specifically indicated.
   13. Concealed pipes, ducts, and conduits.
   14. Architectural woodwork.
   15. Metal lockers.
   16. Elevator equipment.

F. Refer to Section 09 91 03 - Surface Preparation for Renovation Painting for procedures related to preparation of existing surfaces and substrates indicated to receive coatings.

1.02 RELATED SECTIONS

A. Section 09 91 03 – Surface Preparation for Renovation Painting

B. Section 09 91 05 – Renovation Painting

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

B. Gloss ranges used in this Section include the following:
1. Flat refers to a lusterless or matte finish with a gloss range below 5 when measured at a 60-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 10 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 10 and 35 when measured at a 60-degree meter.
4. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

C. Concealed to View: Refers to surfaces, materials, assemblies, or items that cannot be accessed without moving a permanent building element, such as portion of wall or ceiling.

D. Exposed to View: Refers to any item or surface that is not concealed.
1. Exposed to Public View: Refers to any item located, mounted or otherwise situated so as to be viewable from a height of 18" - 80" above finished floor level from a public location. A public location is defined as any area of the building that does not restrict access by the intended occupants of the building, or is accessible only to building maintenance or engineering staff.

1.04 REFERENCE STANDARDS

A. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. ASTM D3359 - Standard Test Method for Rating Adhesion by Tape Test; 2017.

D. ASTM D6677 - Standard Test Method for Evaluating Adhesion by Knife; 2007.

E. NFPA 10 - Standard for Portable Fire Extinguishers; 2017.

F. PDCA P1 - Touch Up Painting and Damage Repair: Financial Responsibility and Definition of a Properly Painted Surface; Current Edition.

G. PDCA P5 - Benchmark Sample Procedures for Paint and Other Decorative Coating Systems; Current Edition.

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

I. SSPC-SP 1 - Solvent Cleaning; 2015.

J. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

K. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

L. SSPC-SP 7 - Brush-Off Blast Cleaning; 2007.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
   3. Require attendance by all affected installers including but not limited to
      a. Contractor's Superintendent
      b. Installer
      c. Manufacturer/Fabricator Representative
      d. Other affected Subcontractors
      e. Architect
      f. Owner’s Representative
   4. Review substrates and detail any necessary repair work.
   5. Verify that expansion joints, joints at change of plane, joints at change of substrates, and joints at all penetrations by signage, downspouts, or gutters have been sealed. Joints must be sealed before application.
   6. Review the Benchmark Sample for the following:
      a. Surface Preparation.
      b. Coverage rates.
      c. Color.
      d. Sheen uniformity.
      e. Pinholing.
      f. Application techniques.
   7. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect, Owner’s Representative and those affected by decisions made.

1.06 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Initial Selection Samples: Submit manufacturer's color charts illustrating full range of available colors and textures for each type of product and finish required for the Project.
   1. Confirm availability of colors specified by Architect with the manufacturer and notify the Architect in writing if any discrepancies, including lack of availability, should occur.

D. Verification Samples: Submit three "draw down" samples, 12 by 12 inches in size, illustrating range of colors and sheens available for each finishing product specified, prepared on hardboard.
   1. Each sample shall be labeled with the following:
      a. Project name and number.
      b. Date.
      c. Manufacturer's name.
      d. Installer's name.
      e. Product name.
      f. Product number.
      g. Color name and number as stated in the color schedule.
      h. Name, address, and phone number of the supplying facility.
   2. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
   3. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application (e.g. "classroom ceiling").

E. Warranty Documentation: Provide a letter of "intent to warranty," including manufacturer warranty and ensuring that forms have been completed in Owner's name and registered with manufacturer for length of term indicated in warranty paragraphs below.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 5% of the amount installed, but not less than 1 gallon of each finish and color; from the same product run, store where directed.
   3. Label each container with color and room names or numbers where paint was used without obscuring manufacturer's label.
   4. Deliver materials to the location designated by the Owner’s Representative.

1.07 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years documented experience and written approval by the manufacturer.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.08 MOCK-UP

A. Provide mock-up of each type of coating on each substrate required, 10 feet long by 10 feet wide, illustrating coating, color, and surface sheen, for each specified coating. Comply with procedures in PDCA P5. Duplicate finish of approved sample submittals.

B. Locate where directed.

C. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
   1. After finishes are accepted, the Architect will use the room to evaluate coating systems of a similar nature.

D. Approved benchmark mockups will be used to evaluate coating systems.

E. Obtain Architect's approval of benchmark mockups before starting application of coatings.

F. Final approval of colors will be from benchmark mockups.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

D. Fire Protection: Furnish fire protection, including, but not limited to, portable fire extinguishers, on site as required by authorities having jurisdiction. Comply with NFPA 10 for selection, distribution, and use of units. In addition, furnish fire protection equipment at locations where heat removal methods are used.

1.10 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Do not install painting until permanent lighting systems has been installed and is operational.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Sherwin-Williams Company (S-W). SINGLE SOURCE PER FPDDCC STDS.

C. Stains:
1. Sherwin-Williams Company (S-W). SINGLE SOURCE PER FPDDCC STDS.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions. Contractor to provide correct paint type to match color and finish of adjacent surfaces.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS

A. Concrete Substrates:
1. Wall and Ceilings (Dry Environments):
   a. One (1) coat, latex primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.0 mil
      3) S-W: Loxon Int/Ext Concrete & Masonry Primer, A24W8300 (< 100 g/L VOC).
   b. Two (2) coats, acrylic-latex enamel (eggshell): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils
      3) S-W: ProMar 200 Zero VOC Interior Latex Egg Shell, B20W2600 (<50 g/L VOC).
2. Walls and Ceilings (Wet Environments):
   a. One (1) coat, epoxy primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.0 mil
      3) S-W: Pro Industrial WB Catalyzed Interior Gloss or EggShell, B73 Series (< 50 g/L VOC).
   b. One (1) coat, epoxy finish: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils

3) S-W: Pro Industrial WB Catalyzed Interior Gloss or EggShell, B73 Series (< 50 g/L VOC)

B. CMU Substrates:
1. Dry Environments:
a. One (1) coat, latex block filler: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils

3) S-W: Preprite Latex Block Filler, B25W25 (<50 g/L VOC).

b. Two (2) coats, acrylic-latex enamel (eggshell): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils

3) S-W: ProMar 200 Zero VOC Interior Latex EggShell, B20W2600 (<50 g/L VOC).

2. Wet Environments:
a. One (1) coat, epoxy block filler: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 10.0 mils

3) S-W: Heavy Duty Block Filler, B42W46 (< 100 g/L VOC).

b. Two (2) coats, epoxy finish (Wet Environments): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils

3) S-W: Pro Industrial WB Catalyzed Interior Gloss or EggShell, B73 Series (< 50 g/L VOC).

C. Gypsum Board Substrate:
1. Walls:
a. One (1) coat, latex primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

3) S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (< 50 g/L VOC).

b. Two (2) coats, -acrylic-latex enamel (semigloss): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6- mils.

3) S-W: ProMar 200 Zero VOC Interior Latex Semigloss, B20W2600 (< 50 g/L VOC).

2. Walls: Factory-formulated epoxy interior finish for interior gypsum board application.
   a. Primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.1 mils
      3) S-W: ProMar 200 Primer, B28W8200
   b. Epoxy Finish Coats: Two coats applied at 2.5 - 3.0 mils dry per coat
      3) S-W: ProIndustrial WB Catalyzed Epoxy, Gloss or EggShell, B73 Series
3. Ceilings: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils
   a. One (1) coat, latex primer:
      3) S-W: ProMar 400 Zero VOC Interior Primer, B28W4600 (< 50 g/L VOC).
   b. Two (2) coats, Acrylic-Latex (flat): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6- mils.
      3) S-W: ProMar 400 Zero VOC Interior Latex Flat, B30-4600 (< 50 g/L).

D. Plaster Substrates:
1. Walls:
   a. One (1) coat, latex primer: applied at spreading rate recommended by the
      3) S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (< 50 g/L VOC).
      4) Tnemec: Series 1026 Enduratone (48 g/L).
   b. Two (2) coats, -acrylic-latex enamel (semigloss): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
      3) S-W: ProMar 200 Zero VOC Interior Latex Semigloss, B20W2600 (< 50 g/L VOC).
2. Ceilings:
   a. One (1) coat, latex primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.
      3) S-W: ProMar 200 Zero VOC Interior Primer, B28W02600 0 g/L VOC).

b. Two (2) coats, Acrylic-Latex (flat): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

3) S-W: ProMar 400 Zero VOC Interior Latex Flat, B30-4600 (< 50 g/L).

E. Steel Substrate:

1. Hollow Metal Doors and Frames:
   a. One (1) coat, water based primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils

      3) S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 (< 100 g/L).

   b. Two (2) coats, alkyd/oil eggshell enamel: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

      3) S-W: ProMar 200 Interior WB Acrylic-Alkyd Semi-Gloss, B33-8200 (< 100 g/L VOC).
      4)
2. Handrails
   a. One (1) coat, water based primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils

      3) S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 (<100 g/L VOC).

   b. Two (2) coats, two component, water-based epoxy (gloss): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

      3) S-W: Pro Industrial Waterborne Catalyzed Epoxy, B73-300 Series (<50 g/L VOC).
3. Galvanized-Metal Substrates & Ductwork: Use heat resistant materials where required due to thermal output of item to be painted.
   a. One (1) coat, water based primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils

      3) S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 (< 100 g/L VOC).

   b. Two (2) coats, Water based enamel (satin): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

[redacted]

3) S-W: Pro Industrial High Performance Acrylic EggShell, B66-660 (< 50 g/L VOC).

[redacted]

4. Overhead Metal Roof Decking - (PrePrimed Steel):
   a. Two (2) coats, Water Based Interior Dry Fog: Applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4.0 mils

[redacted]

3) S-W: Pro Industrial Acrylic Dryfall, B42-80 Series, Flat, EggShell, or Semi-Gloss (< 50 g/L VOC).

[redacted]

5. Overhead Metal Roof Decking - (Galvanized):
   a. Two (2) coats, Water Based Interior Dry Fog: Applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4.0 mils

[redacted]

3) S-W: Pro Industrial Waterborne Acrylic Dryfall, B42-80 Series (<50 g/L VOC) Flat, EggShell, or SemiGloss.

[redacted]

F. Wood Substrate:
   1. Doors, Frames, Trim, Beams, Wood Paneling and Chair Rails
      a. Opaque Alkyd System:
         1) One (1) coat, latex primer: applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

[redacted]

c) S-W: Preprite Problock Latex, B51-600 (<50 g/L VOC).

         2) Two (2) coats, alkyd/oil enamel (semi-gloss): applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

[redacted]

c) S-W: ProMar 200 WB Acrylic-Alkyd Semi-Gloss, B34-8200 (<100 g/L VOC).

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Fastener Head Cover Material: Latex filler.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished with the applicator present prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Test moisture content of surfaces using an electronic moisture meter. Do not begin application of coatings unless moisture content of exposed surfaces (either new or bare), including fillers and patching materials, is below the following maximum values:
1. Gypsum wallboard: 12 percent.
2. Plaster: 12 percent.
3. Masonry surfaces: 12 percent.
4. Finish woodwork: 7%-10% moisture content
5. Wood surfaces: 15 percent.
6. Vertical concrete surfaces: 12 percent.
7. Horizontal concrete surfaces: 8 percent.

E. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:
1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

H. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Galvanized Surfaces:
1. Clean to remove soluble contaminants with solvent or water-based cleaner/degreaser in accordance with SSPC-SP 1. If new zinc-coated metal, remove oil/passivator coating according to SSPC-SP 7.
2. Remove rust according to SSPC-SP 3.
3. Galvanizing Repair Paint: Provide SSPC-Paint 20 with dry film containing 94-percent (min.) zinc dust by weight to repair damaged galvanized coating according to ASTM A780/A780M.

L. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

M. Wood Surfaces to Receive Opaque Finish: Wipe off and vacuum dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

N. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

O. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish. Clean surfaces prior to applying next coat.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

K. Reinstall louvers, grilles, covers, and access panels on mechanical and electrical components.

3.04 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following field inspection test procedures at any time and as often as the Owner deems necessary during the period when paint is being applied:
   1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
   2. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove non-complying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.
   3. Surfaces painted with rejected materials will have surface preparation re-done in accordance with specifications at Contractor's expense.
   4. The testing agency will perform on site and laboratory tests for the following characteristics as required by the Owner’s Representative:
      a. Adhesion Tests: ASTM D3359 and ASTM D6677.
      b. Film thickness tests.
      c. Quantitative materials analysis.
      d. Apparent reflectivity.
      e. Washability.
      f. Dry Capacity.

3.05 CLEANING

A. Daily Cleanup: At the end of each work day, remove empty cans, rags, cleaning pads, rubbish, and other discarded paint materials from the site.

B. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces or to generate dust.

C. Final Cleanup: After completing painting, area shall be thoroughly cleaned to remove all dust and spattered paint and patching materials. All surfaces shall be washed clean to remove all dust and dirt, including dust and dirt that existed prior to painting. All Surfaces to be cleaned include every exposed surface in the space such as, walls, floors, ceilings, ledges, sills, soffits, surfaces of fixed equipment and accessories, conduits, wires, ducts, etc. Movable furniture and furnishings are required to be sealed in plastic sheeting prior to start of work. In the event of failures of polyethylene sheet, clean covered furniture and furnishings to remove dust.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion. Comply with procedures specified in PDCA P1.

END OF SECTION 09 91 23

SECTION 09 96 02
HIGH PERFORMANCE COATINGS - OVER STRUCTURAL GLAZED TILE

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. High-performance resinous wall and ceiling coating systems for use over structural glazed tile and similar substrates as a wainscot as shown on the drawings. Product is intended to be the same manufacturer, and general color profile as the selected Fluid-Applied Epoxy Flooring as specified in Section 09 67 00. Wall surface preparation shall conform to requirements of Section 09 91 03 “Surface Preparation for Renovation Painting” and as required by the Manufacturer of the product for proper adhesion and long-term performance.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Installer Qualification Statement: Signed by manufacturer stating that installers comply with specified requirements.
C. Material Certificates: For each resinous coating component, from manufacturer.
D. Maintenance Data: For maintenance manuals.
E. Samples: Provide initial color sample from manufacturer’s full range for initial selection by Owner / Architect.
F. Submit two 6 inch by 6 inch samples of selected colors / finishes for each resinous coating system applied to a rigid backing for final selection. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Architect/Owner in writing prior to installation.
G. Product Schedule: For resinous wall and ceiling coating systems.

1.04 QUALITY ASSURANCE

A. Manufacturer QA/QC: Installer shall provide a letter from Manufacturer affirming the product selection for the surfaces the product is to be applied to and confirming surface preparation procedures and requirements for warranty and successful long-term performance.
B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of systems required for this Project.
    1. Engage an installer who is approved in writing by coating manufacturer as qualified to apply resinous wall and ceiling systems indicated.
    2. Installer Letter of Qualification: Installer to provide letter stating that they have been in business for at least 5 years and listing 5 projects in the last 2 years of similar scope. For

each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.

C. Source Limitations: Obtain primary resinous coating materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials. Manufacturer utilized for work under this Section shall be the same as used for Section 09 67 00 “Fluid-Applied Epoxy Flooring”.

D. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.

1.05 MOCKUPS:

A. Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.

B. Apply full-thickness mockups on 16 square foot floor area selected by Architect/Engineer of Record.

C. Finish surfaces for verification of products, color, texture, and sheen.

D. Simulate finished lighting conditions for Architect/Engineer of Record's review of mockups.

E. Approved mockups may become part of the completed Work if undisturbed at time of Preliminary Acceptance.

F. Mockup shall demonstrate desired slip resistance for review and approval by Owner’s Representative in writing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous coating system manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous coating application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during coating application.

C. Close spaces to traffic during coating application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 PRODUCTS

2.01 HIGH-PERFORMANCE COATINGS OVER STRUCTURAL GLAZED TILE

A. Stonhard:

1. Stonglaze VSR – 13 – 15 mil epoxy wall coating

2. Stonseal CA7 Clear Urethane Sealer – topcoat.

B. Crossfield:
1. Wallcote E - Wall System
2. Urethane sealer topcoat.

C. Sherwin-Williams Company (S-W): www.sherwin-williams.com
1. ResuWall Aqua, 10-14 mils nominal thickness. – Existing Tile
   a. Primer: Resuprime VP 5531 at 750 sq. ft. per gallon.
   b. Base Coat (2 Coats @ 3-5 mils): Resuflor Aqua 3479 at 300-350 sq. ft. per gallon.
   c. Finish Coat: ResuTile 4410 or 4411 at 400-500 sq. ft. per gallon.
2. ResuWall Deco Flake – Existing Tile
   a. Pre-Primer for Ceramic Tile: Resuprime VP 5531 at 750 sq. ft. per gallon.
   b. Primer: Resuflor Aqua 3462 at 250-400 sq. ft. per gallon.
   c. Broadcast: 6750D/6755D to excess.
   d. Bonding Coat: Resuflor Aqua 3461 at 250-400 sq. ft. gallon.
   e. Second Broadcast: 6750D/6755D to excess.
   f. Grout Coat: Resuflor Aqua 3461 at 250-400 sq. ft. per gallon.
   g. Seal Coat: Resutile Aqua 4410 at 300-450 sq. ft. per gallon. (topcoat)

2.02 MATERIALS

A. VOC Content of Resinous Coating: Provide resinous coating systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D.

2.03 PERFORMANCE CHARACTERISTICS

A. Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic coating designed to produce a seamless finish.

B. Color and Pattern: As indicated from manufacturers listed above.

C. Slip Resistance: Provide smooth, orange peel finish unless otherwise specified.

PART 3 EXECUTION

3.01 PREPARATION

A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate, or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.

B. Surface Preparation: Remove all paints, surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable, try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers as follows:

C. Surface Preparation Glazed Block, Glazed Tile, Glazed Brick: Remove all paints, surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds,

paint, dust and debris. Abrade to reduce sheen and impart surface texture. Rinse residual dust and solvents. Allow to dry. If surface is questionable, try a test patch.

D. Concrete Surface Profile (CSP)
   1. Thin film, to 10 mils: CSP-1 to CSP-3
   2. Thin and medium films, 10 to 40 milsCSP-3 to CSP-5
   3. Self-leveling mortars, to 3/16 inch: CSP-4 to CSP-6
   4. Mortars and laminates, to 1/4 inch or more: CSP-5 to CSP-10
E. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
   1. Moisture Testing: Perform tests indicated below.

3.02 CALCIUM CHLORIDE TEST:

A. Perform anhydrous calcium chloride test per ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours. Perform tests so that each test area does not exceed 1000 sq. ft. and perform 3 tests for the first 1000 sq. ft. and one additional test for every additional 1000 sq ft.
   1. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

3.03 ENVIRONMENTAL CONDITIONS

A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly instructions shall be implicitly followed.
B. Repair damaged and deteriorated concrete according to resinous coating manufacturer's written instructions.
C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
D. Resinous Materials: Mix components and prepare materials according to resinous coating manufacturer's written instructions.
E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous coating according to manufacturer's written instructions.

3.04 APPLICATION

A. Install resinous coating system over properly prepared surfaces in strict accordance with the manufacturer's directions.
   1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
   2. Install topcoat over resinous coating system after excess aggregate or sand dust has been removed.
   3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying resinous coatings, or as instructed by manufacturer.
B. Apply components of resinous coating system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous coating system to substrate, and optimum intercoat adhesion.
2. Cure resinous coating components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, comply with resinous coating manufacturer's written instructions.

C. Sealant: Saw cut resinous coating at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer’s written recommendations.

D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

E. Sand between coats and remove sand dust prior to next coat.

F. Apply topcoats in number indicated for coating system and at spreading rates recommended in writing by manufacturer.

3.05 CLEANING

A. Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.

3.06 PROTECTION

A. Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

B. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

END OF SECTION 09 96 02

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Exterior signage:
   1. ADA required way-finding.
   2. Room / Space signage.

C. Building identification signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

E. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2016.

F. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, including installation instruction, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign, and installation instructions.

C. Shop Drawings for Specialty: Submit shop drawings for fabrication and erection of specialty signs. Include plans, elevations and large-scale details of sign wording and lettering layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.

D. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect/Engineer of Record at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect/Engineer of Record prior to fabrication.

E. Samples: Submit two samples of each type of sign, of size similar to that required for project or full-size samples if requested by Architect/Engineer of Record, illustrating sign style, font, and method of attachment.

F. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips for background color within contrast range specified against white graphics for selection by the Architect/Engineer of Record.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
   1. For each sign type and graphic image process indicated, furnish products of a single manufacturer.

B. Installer Qualifications: Engage an experienced Installer who is acceptable to the sign manufacturer and has completed installation of interior signs similar in material, design, and extent to those indicated for the Project and that has resulted in construction with a record of successful in service performance.

1.05 COORDINATION

A. Room and Door Signs: Meet with the owner to establish the room numbering and naming system.

B. Exterior Signs: For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Field Measurements: Where required for signage type indicated, take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

B. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

C. Maintain this minimum temperature recommended by manufacturer during and after installation of signs.

PART 2 - PRODUCTS

2.01 SIGNAGE

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat cast acrylic signs with photopolymer on an acrylic substrates for raised graphic panel media without frame as specified.
   2. Edges: Square.
   3. Corners: Square.
   4. Tolerance: Plus or minus 1/16" measured diagonally from corner to corner.
   5. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   6. Include the following types:
      a. One 9” x 3” room number or name sign at each door opening.
      b. One 9” x 9” restroom identification sign at each restroom.
      c. Signs as required by accessibility requirements.
      d. Other signs shown on drawings.
   7. Wall Mounting of One-Sided Signs: Concealed screws for gypsum board, masonry and CMU.

C. Exterior ADA-Wayfinding Signs:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
      a. ASI Sign Systems, Inc.
      b. Nelson-Harkins Industries
      c. Poblocki & Sons, Inc.
   2. Sign Type: Flat aluminum sheet and plate signs, unframed.
   3. Edge Condition: Square cut.
   4. Corner Condition: Radius
   5. Thickness: 1/4”
   6. Etched Copy: Etch letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
      a. Etched Metal: Fill etched copy with enamel.
   7. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory-paint black.

D. Color and Font: Background and message color must contrast by a minimum of 70%. Unless otherwise indicated:
   1. Character Font: As indicated, or if not indicated, as selected from manufacturer's full range..
   2. Character Case: As indicated, or if not indicated, as selected by Architect/Engineer of Record.
   3. Background Color: Dark color, as selected from manufacturer's full range.
   4. Character Color: White color.

2.02 MATERIALS

A. Cast Acrylic Sheet: Cast (not extruded or continuous cast) methacrylate plastic sheet with a minimum flexural strength of 16,000 psi. ASTM D790, minimum allowable continuous service temperature of 180 deg F; minimum 1/8” thick.

B. Photopolymer: Photopolymer on metal substrate for raised graphics signs.

C. Aluminum Sheet: Provide aluminum sheet of alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B209 for 5005-H15.

D. Aluminum Extrusions: Provide aluminum extrusions of alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B221 for 6063-T5.

E. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.

2.03 ACCESSORIES

A. Concealed Screws: Stainless steel, or aluminum oval head screws having slots requiring special driver tool for vandal resistance and expansion shields for mountable in CMU or Gypsum board.
   1. Provide two (2) screwdrivers to fit slotted heads to Board.

B. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

C. Tape Adhesive: Double sided tape, permanent adhesive.

2.04 FABRICATION

A. Fabricate signs to comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes and details of construction having 1/32” raised copy and grade 2 Braille.

B. Produce smooth, even, level sign surfaces, constructed to remain flat under installed condition with in a tolerance of plus or minus 1/16" measured diagonally form corner to corner, square corners.

C. Bond photopolymer to an acrylic backplate.

D. Fabricate room and doors signs with an acrylic polyurethane consisting of a prime coat and a matte finish coat. Background color to be dark. Message color to be white. Contrast between background and message color to be a minimum of 70%.

E. Room Signs: Characters to be upper case, sans serif, and comply with ADA Standards for depth, proportion, style, height, stroke thickness, character, and line spacing.

F. Pictograms to comply with ADA requirements and have field height of 6" minimum.

G. Directional and Informational Signs: Character heights to comply with ADA Standards based on height from floor and viewing distance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Room and Door Signs: Install in accordance with manufacturer's instructions.
   1. Use one-way wood or metal screws full threaded, countersunk with oval heads finished to match sign background in CMU and Gypsum board.
   2. Use high bond tape and elastic adhesive on glass. Signs mounted on glass must have 1/16" acrylic backplate matching the sign color and size attached to the opposite side of the glass
   3. Typically located as follows:
      a. On the wall to the latch side of the door.
      b. 48" minimum above finished floor to baseline of lowest tactile character and 60" maximum above finished floor to baseline of highest tactile character.
      c. Where tactile sign is provided at double doors, locate signs on the nearest adjacent wall at heights specified above.
      d. 2” from the door frame.

B. Exterior Signs: Use nonremovable aluminum mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended by sign manufacturer.

C. Building Identification Signs: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
   1. Projected Mounting: Mount letters at the projection distance from the wall surface indicated.

D. Install neatly, with horizontal edges level.

E. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

F. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION 10 14 00

SECTION 10 21 13
TOILET COMPARTMENTS

Display hidden notes to specifier. (Don't know how? Click Here)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid Color Reinforced Composite (SCRC) Substrate: (Bobrick SierraSeries).
   1. Toilet partitions.
   2. Urinal privacy screens.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications.

B. Section 06 10 00 - Rough Carpentry.

C. Section 10 28 00 – Toilet, Bath, and Laundry Accessories.

1.3 SUBMITTALS

A. Submit under provisions outlined in PBC Book 2.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit manufacturer's shop drawings for each product specified, including the following:
   1. Plans, elevations, details of construction and attachment to adjacent construction.
   2. Show anchorage locations and accessory items.
   3. Verify dimensions with field measurements prior to submitting shop drawings, reflect field-verified dimensions on submittals for each location.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

D. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.7 PROJECT CONDITIONS

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

1.8 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 WARRANTY

A. Manufacturer's Warranty (SierraSeries): Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Bobrick Washroom Equipment, Inc., which is located at: 6901 Tujunga Ave.; North Hollywood, CA 91605-6213; Tel: 818-764-1000; Fax: 818-765-2700; Email:info@bobrick.com; Web:www.bobrick.com

B. Products (sole-source): Based on the quality and performance requirements of the project, specifications are based solely on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.

2.2 SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE (SierraSeries)

A. Solid Color Reinforced Composite (SCRC) Toilet Partitions: Bobrick SierraSeries.
   1. Design Type:
      a. Standard Height.
         1) Door/Panel Height: 58 inches (147 cm).
         2) Floor Clearance: 12 inches (30 cm).
   2. Mounting:
      a. Floor-mounted, overhead-braced with extruded anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.
         1) Stile Maximum Height: 83 inches (211 cm).

B. Solid Color Reinforced Composite (SCRC) Urinal Screens: Bobrick SierraSeries.
   1. Mounting Configuration:

      a. Wall-hung.
         1) Screen Height: 42 inches (107 cm) with 18 inches (46 cm) floor clearance.

C. Materials: Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick GraffitiOff coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable.
   1. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
   2. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a manufacturing steps requiring thermal and mechanical pressure.
   3. Edges: Same color as the surface.
   4. Color:
      a. SC03 Terra Cotta.
   5. Acceptable SCRC Products: Or manufacturer approved equal.
      a. Ultimate Corian System by Shower Shapes.

D. Performance Requirements:
   1. Graffiti Resistance (ASTM D 6578): Passed cleanability test; 5 staining agents.
   2. Scratch Resistance (ASTM D 2197): Maximum load value exceeds 10 kilograms.
   3. Impact Resistance (ASTM D 2794): Maximum impact force exceeds 30 inch-pounds.
   4. Smoke Developed Index (ASTM E 84): Less than 450.
   5. Flame Spread Index (ASTM E 84): Less than 75.
   6. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
   7. Uniform Building Code: Class II.

E. Finished Thickness:
   1. Stiles and Doors: 3/4 inch (19 mm).
   2. Panels and Screens: 1/2 inch (13 mm).

F. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.
   1. Leveling Devices: 7 gauge, 3/16 inches (5 mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
   2. Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

G. Hardware: Chrome-plated "Zamak", aluminum, extruded plastic hardware not acceptable.
   1. Compliance: Operating force of less than 5 lbs. (2.25 kg).
   2. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
   3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
   4. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
   5. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
      a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lbs. (680 kg) per insert.
   6. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
   7. Door Latch with Occupancy Indicator: Track of door latch prevents inswing doors from

swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge (1.6 mm) sliding door latch, 14 gauge (2 mm) keeper.

8. Locking: Door locked from inside by sliding door latch into keeper, includes occupancy indicator.
9. Hinge Type:
    a. Full-Height Institutional Hinge.
        1) Hinges: 16 gauge (1.6 mm) stainless steel, self-closing, 3 section hinges.
10. Mounting Brackets:
    a. Full-Height.
        1) Mounting Brackets: 18 gauge (1.2 mm) stainless steel and extend full height of panel.
        2) U-Channels: Secure panels to stiles.
        3) Angle Brackets: Secure stiles-to-walls and panels to walls.

PART 3 PRODUCTS

3.1 PREPARATION

A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

C. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
2. Verify location does not interfere with door swings or use of fixtures.
3. Use fasteners and anchors suitable for substrate and project conditions
4. Install units rigid, straight, plumb, and level.
5. Conceal evidence of drilling, cutting, and fitting to room finish.
6. Test for proper operation.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

B. Touch-up, repair or replace damaged products.

C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 10 21 13

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.
G. ASTM C1036 - Standard Specification for Flat Glass 2021.
H. ASTM F446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area 1990.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See PBC Book 2 for submittal procedures.
B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Drawings for each accessory and room numbering.
D. Maintenance Data: For toilet accessories to be included in Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet Accessories:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bobrick Washroom Equipment, Inc: www.bobrick.com
   3. Bradley Corporation: www.bradleycorp.com/#sle.

4. Gamco Commercial Restroom Accessories; a division of Bobrick Washroom Equipment, Inc.: www.gamcousa.com

2.02 TOILET ACCESSORY SCHEDULE

NOTE: FPDCC has requested single-source accessories identified below, substitutions will not be considered. The letter-designations in square brackets is drawing designation:

A. Toilet Tissue Dispensers: [C1]
   1. Dual Jumbo-Roll Dispenser:
      a. Location: At water closets, where indicated.
      b. Description: Surface mounted single-roll toilet tissue dispenser with locked cover.
         1) ASI: 0040.
         2) Bobrick: B-2892.
         3) Bradley: 5425.
         4) Gamco: TTD-11.

B. Warm-Air Dryers (SINGLE SOURCE) : [E1]
   1. ADA Compliant, surface mounted hand dryer with electronic sensor, providing hands-free operation and automatic shut off, and fixed air-outlet; cover to be fabricated from stainless steel; electrical requirements: maximum 115 V, 20 amp.
      a. Excel: ThinAir Hand Dryer TA-ABS + Wall Guard – Part #89S

C. Grab Bars:[F1, G1, H1]
   1. Stainless steel tubing, 1-1/2 inch o.d., uniformly bent, with welded flanges and snap-flange cover plates; 0.050 inch minimum wall thickness; satin finish; fabricated in configurations and dimensions as indicated on Drawings.
      a. ASI: 3800 Series.
      b. Bobrick: B-6806 Series.
      c. Bradley: 812 Series.
      d. Gamco: 150 Series.

D. Undersink Protective Pipe Covers: Refer to Division 22 Section, "Plumbing Fixtures." Provide pipe covers at all lavatories and sinks to cover p-trap and assoc. elements.

E. Retrofit Plastic Toilet Seats:
   1. Heavy Duty Plastic Seats with 300 Series Stainless Steel Posts.
      a. Bemis: #1955 CT 000, provide as part of water closet (tag A1)

F. Soap Dispenser: [D1]
   1. Location: Provide soap dispensers in each toilet room as indicated, or as directed by the Architect/Engineer of Record. In food preparation and kitchen areas, provide soap dispenser at each hand sink and in each toilet room as indicated, or as directed by the Architect/Engineer of Record.
   2. Description: Surface mounted, refillable liquid soap dispenser, with a capacity of not less than 40 ounces; fabricated from Plastic
      a. ASI: 0340.

b. Bobrick: B-40.

G. Baby Changing Station: [K1]
   1. Description: Surface-mounted high-density polyethylene-Koala Grey, projects not more than 4-inches from wall when closed, contains a concealed pneumatic cylinder for controlled operation, and is engineered to support a minimum static load of 400 pounds when in open position. Unit shall have built-in dispenser for sanitary liners and protective holding straps.
      a. Koala Kare KB300, gray.
      b. Bobrick: KB110-SSWM.
      c. Bradley: 962-11.

H. Floor Standing Receptacle:
   a. NOT USED

I. Wall Mounted Trash Receptacle:
   1. Description: Surface Mounted 12 Gallon, Stainless Steel, Trash Receptacle, provide one in each of four toilet rooms whether or not tagged.
      a. ASI: 0826
      b. Bobrick: B-277
      c. Bradley: 3565

2.03 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
B. Keys: Provide minimum of 6 keys for each accessory to Owner; master key lockable accessories.
C. Stainless Steel Sheet: ASTM A666, Type 304.
D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating.
F. Laminated Mirror Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q2, nominal 6 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
   1. Interlayer: Minimum 0.03 inch thick interlayer material with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
G. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.
H. Adhesive: Two component epoxy type, waterproof.
I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
J. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.04 FABRICATION

A. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
   1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
B. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
   1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

2.05 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.
B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions, with Installer present, before starting work.
B. Verify exact location of accessories for installation.
C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
D. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
E. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F446.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 28 00

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2017.

B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. See PBC Book 2 for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.04 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Products:
      a. Cosmic 5E; J.L. Industries.
      b. MP5; Larsen's Manufacturing Co.
      c. Model 3005; Potter-Roemer.
   2. Size: 5 pound.
   3. Finish: Baked polyester powder coat, color as selected.

2.02 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished, designed to prevent accidental dislodgement of extinguishers.
   1. Provide brackets for extinguishers not located in cabinets.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

E. Identify bracket-mounted extinguishers with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface. Letter size, style and location as selected by Architect/Engineer of Record.

END OF SECTION 10 44 00

SECTION 10 44 03

INSTALLATION OF FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Installation of bracket mounted fire extinguishers.

B. Installation of fire extinguisher cabinets.

1.02 COORDINATION/HANDLING/STORAGE

A. Coordinate delivery of units with the fire protection trade furnishing the units through the General Contractor.

B. Coordinate locations, sizes of openings, framing and behind finish wall reinforcing.

C. Receive, handle and store in exact accordance with unit manufacturer’s recommendations and in a manner to prevent damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide attachment and security devices not furnished with the unit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in exact accordance with manufacturer’s recommendations and instructions, plumb, level, tight to surface, true to location required for accessibility in a secure manner.

B. Ensure proper door operation.

C. Replace damaged units at no additional cost to Owner.

D. Place decal on doors plumb and level.

E. Install fire extinguishers.

F. Provide keys to General Contractor for transmittal to Owner.

END OF SECTION 10 44 03

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES
- A. Valve tags
- B. Pipe labels.

1.02 SUBMITTALS
- A. Product Data: For each type of product indicated.
- B. Valve numbering scheme.
- C. Valve Schedules: For each piping system to include in maintenance manuals.

1.03 DELIVERY, STORAGE AND HANDLING
- A. Store materials in a dry and secure area on-site and protect against dirt and moisture damage.
- B. Do not apply or install damaged materials.

PART 2 – PRODUCTS

2.01 VALVE TAGS
- A. Manufacturers:
  1. Brady Corporation: www.bradycorp.com/#sle.
  2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
  3. Seton Identification Products: www.seton.com/#sle.
- B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  1. Tag Material: Brass, 0.032 inch thick, or stainless steel, 0.025 inch thick, with predrilled holes for attachment hardware.
  2. Fasteners: Brass beaded chain.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  1. Valve-tag schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS
- A. Manufacturers:
  1. Brady Corporation: www.bradycorp.com/#sle.
  2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
  3. Seton Identification Products: www.seton.com/#sle.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 INSTALLATION

A. GENERAL INSTALLATION REQUIREMENTS
   1. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
   2. Coordinate installation of identifying devices with locations of access panels and doors.
   3. Install identifying devices before installing acoustical ceilings and similar concealment.

B. PIPE LABEL INSTALLATION
   1. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
      a. Near each valve and control device.
      b. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
      c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
      d. At access doors, manholes, and similar access points that permit a view of concealed piping.
      e. Near major equipment items and other points of origination and termination.
      f. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.
      g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
   2. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in all piping systems, directional arrows shall encompass the entire pipe and/or insulation on pipe.
   3. Pipe Label Color Schedule:
      a. Domestic Cold Water Piping: Green Background, White Lettering
      b. Domestic Hot Water and Hot Water Recirc. Piping: Green Background, White Lettering
      c. Sanitary Waste and Storm Drainage Piping: Green Background, White Lettering

C. VALVE-TAG INSTALLATION
   1. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
   2. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
      a. Valve-Tag Size and Shape:
         1) Domestic Cold Water: 2 inches, round.
         2) Domestic Hot Water and Hot Water Return: 2 inches, round.
      b. Valve-Tag Color:
         1) Domestic Cold Water: Natural.
         2) Domestic Hot Water: Natural.
      c. Letter Color:
         1) Domestic Cold Water: Black.
         2) Domestic Hot Water: Black.

3.03 SAMPLE SCHEDULES

A. The following tables are examples of schedules required to be submitted by the Contractor. Example information has been included in the first row of the tables for reference only.

VALVE TAG SCHEDULE - DOMESTIC COLD WATER					
VALVE NUMBER	**VALVE TYPE**	**VALVE SIZE**	**VALVE LOCATION**	**NORMAL OPERATING POSITION**	**REMARKS**
CWS-1	GATE	NPS 2	MECHANICAL ROOM M-1	OPEN	

EQUIPMENT LABEL SCHEDULE				
EQUIPMENT IDENTIFICATION	**EQUIPMENT LOCATION**	**SPEC NUMBER**	**SPEC TITLE**	**REMARKS**
DWBP-1	MECHANICAL ROOM M-215	22 XX XX		DOMESTIC WATER BOOSTER PUMP

END OF SECTION 22 05 53

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation materials (Including cements, adhesives, and mastics).

B. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Shop Drawings:
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   3. Detail removable insulation at piping specialties, equipment connections, and access panels.
   4. Detail application of field-applied jackets.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in other sections.

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

1.08 WARRANTY

A. Provide warranty on materials and labor for 18 months starting from date of delivery, or one year from date of preliminary acceptance, whichever is longer.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation

2. Johns Manville Corporation
3. Knauf Insulation
4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ

B. Preformed Pipe Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.
4. Provide with factory-applied ASJ-SSL jacket.

C. Insulating Cement: ASTM C195
1. Manufacturers:
a. Insulco, Division of MFS, Inc.; Triple I.
b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

D. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

E. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

F. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

G. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00 - Firestopping.

3.03 PIPING INSULATION SCHEDULES

A. General: Abbreviations used in the following schedules include:
1. Field-Applied Jackets: P - PVC, K - Foil and Paper, A - Aluminum, SS - Stainless Steel.

B. Interior Domestic Hot Water:

PIPE SIZES (NPS)	MATERIALS	THERMAL CONDUCTIVITY, K	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD APPLIED JACKET
ALL SIZES	GLASS FIBER	0.28	1	NO	(P)

1. NOTE: Increase insulation thickness 1/2” for pipes > 1-1/2” in systems operating between 140 deg F and 169 deg F. Increase insulation thickness 1/2” for 1-1/2” and 2” pipes operating between 170 deg F and 180 deg F. Increase insulation thickness 1” for pipes > 2” operating between 170 deg F and 180 deg F.

C. Interior Domestic Cold Water:

PIPE SIZES (NPS)	MATERIALS	THERMAL CONDUCTIVITY, K	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD APPLIED JACKET
1/2 TO <1 1/2	GLASS FIBER	0.28	1/2	YES, FACTORY INSTALLED	(P)
1 1/2 TO <4	GLASS FIBER	0.28	1	YES, FACTORY INSTALLED	(P)

3.04 INDOOR, FIELD APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
1. PVC, Color-Coded by System: 30 mils thick.

END OF SECTION 22 07 19

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Domestic water piping.
   2. Flanges, unions, and couplings.
   3. Pipe hangers and supports.
   4. Valves.
      a. Flow controls.
      b. Check.
      c. Water pressure reducing valves.
      d. Relief valves.

1.02 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.

B. ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings Classes 150, 300, 600, 900, 1500, and 2500; 2016.

C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2016.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

F. ASME B31.9 - Building Services Piping; 2014.

G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.

H. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2015.

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

J. ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples; 2016.

K. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

P. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; 2016.

Q. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

R. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

S. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017.

T. AWWA C153/A21.53 - Ductile-Iron Compact Fittings; 2011.

U. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017.

V. AWWA C651 - Disinfecting Water Mains; 2014.

W. AWWA C652 - Disinfection of Water-Storage Facilities; 2011.

X. MSS SP-67 - Butterfly Valves; 2017.

Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

Z. NSF 61 - Drinking Water System Components - Health Effects; 2017.

AA. ANSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. See Section 01 33 29 - LEED Sustainable Design Reporting, when required.

C. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

D. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

E. Shop Drawings: Contractor shall submit complete shop drawings showing layout and sizing of all pipes, with all valves, specialties, and other relevant items shown.

F. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with Illinois Plumbing Code.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.

F. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.

G. Comply with NSF 61, for potable domestic water piping and components.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

1.06 FIELD CONDITIONS

A. Existing Utilities: Do not interrupt existing utilities serving facilities except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
   1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without receiving Architect's written permission.

1.07 WARRANTY

A. Provide manufacturer’s standard 1-year warranty for materials and labor, commencing on date of substantial completion.

1.08 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig (860 kPa), unless otherwise indicated.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (Below Grade Applications), Type L (Indoor Above Grade Applications).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
   4. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
   5.

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.04 BALL VALVES

A. Manufacturers:
   1. Nibco, Inc: www.nibco.com.
   2. Conbraco Industries, Inc.; Apollo Div.
   3. Crane Company: www.cranecpe.com.
   4. Watts Industries, Inc.; Water Products Div.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
   1. NPS 3 and smaller: Hard copper tube, Type L, copper pressure fittings; and soldered joints.

3.03 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use bronze ball valves for piping NPS 2-1/2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 3 and larger.

2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2-1/2 and smaller. Use butterfly or gate valves for piping NPS 3 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch, in the hot water return main where branches join together and on discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

3.04 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.05 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.
1. Coordinate size and location of access doors with Section 08 31 00 - Access Doors and Panels.

H. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 05 23 - General-Duty Valves for Plumbing Piping.

I. Install water piping to ASME B31.9.

J. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

K. Sleeve pipes passing through partitions, walls and floors.

L. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Support cast iron drainage piping at every joint.

M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.06 CLEANING AND ADJUSTING

A. Clean and disinfect potable and non-potable domestic water piping as follows:
1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:
1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

D. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.07 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and required corrective action.

3.08 STARTUP AND REPORTING

A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Perform the following steps before putting into operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
   5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use

C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

D. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.09 HANGERS & SUPPORTS SCHEDULES

A. Pipe hangers and supports are specified in Division 23.

B. Domestic Water
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.
5. Support vertical piping and tubing at base and at each floor.
6. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
7. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   a. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
   b. NPS 1-1/2: 108 inches with 3/8-inch rod.
   c. NPS 2: 10 feet with 3/8-inch rod.
   d. NPS 2-1/2: 11 feet with 1/2-inch rod.
   e. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
8. Install supports for vertical steel piping every 15 feet.
9. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   a. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   b. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
   c. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   d. NPS 2-1/2: 108 inches with 1/2-inch rod.
   e. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
10. Install supports for vertical copper tubing every 10 feet.

END OF SECTION 22 11 16

SECTION 22 13 16
SANITARY WASTE & VENT DRAINAGE PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary waste and vent piping.
   2. Unions, and couplings.
   3. Pipe hangers and supports.
   4. Valves and accessories.

1.02 REFERENCE STANDARDS

A. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

B. ASME B31.9 - Building Services Piping; 2014.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.

D. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2017.

E. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

H. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

I. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

J. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

K. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014.

L. NSF 61 - Drinking Water System Components - Health Effects; 2017.

M. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Shop Drawings: Contractor shall submit complete shop drawings showing layout and sizing of all pipes, with all valves, specialties, and other relevant items shown.

D. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with Illinois Plumbing Code.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.

F. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

D. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

1.06 FIELD CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Existing Utilities: Do not interrupt existing utilities serving facilities except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
   1. Notify Architect/Engineer of Record not less than 48 hours in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without receiving Architect/Engineer of Record's written permission.

1.07 WARRANTY

A. Provide manufacturer’s standard 1-year warranty for materials and labor, commencing on date of substantial completion.

PART 2 - PRODUCTS

2.01 SANITARY WASTE AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joints: ASTM B 29, pure lead and oakum.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B).
   1. Fittings: ASME B16.29, wrought copper, ASME B16.23 cast copper.
   2. Joints: ASTM B32, alloy Sn50 solder. Use solder appropriate for the system pressures indicated on plans.
   3. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

2.02 UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

C. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Sleeve Materials:
      a. For Cast-Iron Soil Pipes: ASTM C564, rubber.
      b. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
      c. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

D. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Center-Sleeve Material: Stainless steel.
   2. Gasket Material: Natural or synthetic rubber.
   3. Metal Component Finish: Corrosion-resistant coating or material.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger. 2 percent downward in direction of flow for piping within 40 ft. downstream of a low flow water closed of 1.28 gallon/flush or below.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom, conserve space, and not interfere with use of space.

H. Group piping whenever practical at common elevations.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

K. Sleeve pipes passing through partitions, walls and floors.

L. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Support cast iron drainage piping at every joint.

M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 CLEANING AND ADJUSTING

A. Clean interior of sanitary piping. Remove dirt and debris as work progresses.

B. Protect sanitary drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted sanitary waste and vent piping at end of day and when work stops.

3.05 FIELD QUALITY CONTROL

A. During sanitary waste and vent system installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.06 STARTUP AND REPORTING

A. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

B. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.07 HANGERS & SUPPORTS SCHEDULES

A. Pipe hangers and supports are specified in Division 23.

B. Sanitary Waste & Vent & Storm Sewer
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.
5. Support vertical piping and tubing at base and at each floor.
6. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
7. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   a. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
   b. NPS 3: 60 inches with 1/2-inch rod.
   c. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
8. Install supports for vertical cast-iron soil piping every 15 feet.
9. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   a. NPS 1-1/4: 72 inches with 3/8-inch rod.
   b. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   c. NPS 2-1/2: 108 inches with 1/2-inch rod.
   d. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
10. Install supports for vertical copper tubing every 10 feet.

END OF SECTION 22 13 16

SECTION 23 01 30.51
HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

B. Testing and inspection agency employed by Board.

1.02 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.

1.03 REFERENCE STANDARDS

A. NADCA ACR - Assessment, Cleaning and Restoration of HVAC Systems; 2013.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

C. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.

D. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

E. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Qualifications Statement: Submit qualifications of proposed cleaning contractor for approval.

B. Project Cleanliness Evaluation and Cleaning Plan, as specified.

C. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.05 QUALITY ASSURANCE

A. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
   1. Certified by one of the following:
      a. NADCA, National Air Duct Cleaners Association: www.nadca.com
   2. Having minimum of five years documented experience.
   3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 REPLACEMENT PRODUCTS

A. Fibrous Glass Insulation: Provide material complying with UL 181 equivalent to existing material in quality and thickness.

2.03 DUCT DEODORIZER

A. Equal to Madacide, as supplied by Mateson Chemical, EnviroCon as manufactured by Bio-Cide
1. International, Inc., or approved equal.

2.04 SANITIZER

A. An E.P.A. registered sanitizer "Oxine" as manufactured by Bio-Cide International or approved equal. "BBJ" microbiocide as manufactured by BBJ Chemical Compounds, "Airkem NR Quat" as manufactured by Airkem Industrial Products, or approved equal.

2.05 SURFACE TREATMENTS

A. A duct liner adhesive coating, Foster 40-10, 40-20 or 40-23, as manufactured by Foster Products Corporation, Cover-Al as manufactured by Mateson Chemical Corporation, or approved equal shall be used. Product shall be a quick setting waterbase adhesive and coating designed for field application to faced or unfaced fiberglass duct liner insulation, or to unfaced fiberboard ductboard insulation. The coating shall dry to form an effective air erosion preventive coating, sealing and reinforcing the surface. The coating shall be resistant to fire, water, oil, grease, bacteria, and fungus.

B. Mechanical insulation repair coating, Tough Coat, as manufactured by Vac System Industries, Inc., or approved equal shall be used. The coating material shall contain an anti-microbial agent, shall not affect the thermal or acoustic properties of the insulation, and shall conform to NFPA 90A and NFPA 90B.

PART 3 - EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA ACR and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Obtain Board's approval of proposed temporary locations for large equipment.

E. Designate a decontamination area and obtain Board's approval.

F. If unforeseen mold or other biological contamination is encountered, notify Architect/Engineer of Record immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

B. Perform “Project Evaluation and Recommendation” according to NADCA ACR.

C. Proceed with work only after unsatisfactory conditions have been corrected and after all HVAC equipment renovation has been completed, but prior to the final balancing of the HVAC systems.

D. Start of cleaning work constitutes acceptance of existing conditions.

E. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

F. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Board.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
   3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Board's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. HVAC EQUIPMENT CLEANING
1. General:
    a. Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that debris is not dispersed outside the HVAC system during the cleaning process.
    b. Particulate Collection: Where the particulate collection equipment is exhausting inside the building. HEPA filtration with 99.97% collection efficiency for 0.3 micron size (or greater) particles shall be used. Mechanical cleaning operations shall be undertaken only with particulate collection equipment in place including adequate filtration to contain debris removed from the HVAC system. When the particulate collection equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
    c. Controlling odors: Control offensive odors and/or mist vapors during the cleaning process. Refer to Division 01 Section, "Dust, Fume and Odor Control."
    d. Cleaning: Visibly clean all system components as defined in applicable NADCA standards. Upon completion, all components must be returned to those settings recorded prior to cleaning operations.
    e. Removal: Remove visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications and NADCA recommendations.
    f. Verification: Verification of HVAC system cleanliness shall be determined after mechanical cleaning, but before the application of any treatment or introduction of any treatment-related substance, including biocidal agents and coatings.
2. Air-Volume Control Devices: Existing dampers and any-directional mechanical devices inside the HVAC system to remain must have their position marked prior to cleaning and upon completion must be restored to their marked position.
3. Service Openings: Utilize service openings, at various points of the HVAC system for physical and mechanical entry and inspection.
    a. Utilize the existing openings already installed in the HVAC system where possible.
    b. Other access points shall be provided, where required, and shall be sealed in accordance with industry codes and standards. Refer to Sections 23 31 00- HVAC Ducts and Casings and Section 23 33 00 - Air Duct Accessories.
    c. Closures must not significantly hinder, restrict, or alter the air-flow within the system.
    d. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within insulated systems.
    e. Openings must not compromise the structural integrity of the system.
    f. Construction techniques used in the creation of openings shall conform to requirements of the authority having jurisdiction and applicable NFPA, SMACNA and NADCA standards.
    g. Cutting service openings into flexible duct is not permitted.
    h. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location recorded in project record documents.
4. Air Handling Units, Terminal Units (VAV, FPB, dual duct boxes, etc.) Blowers and Exhaust Fans: Clean supply, return and exhaust fans , including blowers, fan housings,

air chambers and plenums, heaters/cooling coils, scrolls, blades, vanes, shafts, baffles, dampers and drive assemblies. All visible surface contamination shall be removed.
   a. Clean all AHU internal surfaces, components, condensate collectors and drains.
   b. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.
   c. Clean all coils and related components, including evaporator fins.
5. Debris disposal: All debris removed from the HVAC System shall become property of the Contractor and shall be removed from the Site and disposed of legally.
6. Source Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods noted in NADCA ACR. The cleaning method(s) selected shall render the HVAC system visibly clean and capable of passing cleaning verification methods and other specified tests. No cleaning method, or combination of methods, should be used which could potentially damage components, or alter the integrity, of the HVAC system.
   a. All methods shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure.
   b. All vacuum devices, including hand-held and wet vacuums, exhausting air inside the building shall be equipped with HEPA filters (99.97 % efficiency).
   c. All vacuum devices exhausting air outside the facility shall be equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors shall be done in accordance with requirements of authority having jurisdiction.

D. Ducts: Mechanically clean all portions of ducts.

E. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

F. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

G. Biocidal Agents and Coatings:
1. Biocidal agents shall only be applied if active fungal growth is found, or where unacceptable levels of fungal contamination have been verified through the testing.
2. Application of any biocidal agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
3. Only biocidal agents registered by the U. S. Environmental Protection Agency (EPA) specifically for use within HVAC system shall be used.
4. Biocidal agents shall be applied in strict accordance with manufacturer's instructions.
5. Biocidal coating products for both porous and non-porous surfaces shall be EPA registered, water soluble solutions.

H. Fibrous Glass Material: Use HEPA vacuuming equipment, under constant negative pressure, do not permit to get wet, and do not damage surfaces; replace material damaged by cleaning operations.

I. Existing Damaged Fibrous Glass Material: Report to Architect/Engineer of Record all evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture that cannot be remedied by cleaning or resurfacing with an acceptable insulation repair coating.
1. Material with active fungal growth is considered unremediable.
2. Remove unremediable material and clean underlying surfaces.

J. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

K. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Board in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. Notify Architect/Engineer of Record when cleaned components are ready for inspection.

E. Notify Board's testing and inspection agency when cleaned components are ready for inspection.

F. Board reserves the right to verify cleanliness using NADCA ACR Surface Comparison Testing or NADCA Vacuum Test.

G. When directed, re-clean components until they pass.

H. Contractor shall bear the costs of retesting due to inadequate cleaning.

I. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.

C. NEMA MG 1 - Motors and Generators; 2017.

D. NFPA 70 - National Electrical Code; 2017.

1.03 SUBMITTALS

A. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements. Provide nameplate data and ratings; shipping, installed, and operating weights; enclosure type and mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
   1. Each installed unit's type and details.
   2. Nameplate legends.
   3. Diagrams of power, signal, and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.

C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

E. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

F. Operation Data: Include instructions for safe operating procedures.

G. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
   1. Compatible with the following:
      a. Magnetic controllers.
      b. Multispeed controllers.
      c. Reduced-voltage controllers.
   2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
   3. Matched to torque and horsepower requirements of the load.
   4. Matched to ratings and characteristics of supply circuit and required control sequence.

B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.07 WARRANTY

A. Written manufacturer’s warranty covering parts and labor for a period of one year from substantial completion, or eighteen months from shipment, whichever is longer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group

B. General Electric

C. Lincoln Motors

D. Marathon

E. Reliance

F. U.S. Motors

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
2. Motors Larger than 1/2 Horsepower: ___ volts, three phase, 60 Hz.

B. Construction:
1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

B. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.06 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.07 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. All three phase motors shall be rated for VFD applications.

G. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

H. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate

bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

L. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

M. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N.

2.08 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Applications:
1. Commercial:
   a. Through-the-Wall Unit:
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the through-the-wall unit and/or specified sequence of operation.
      3) Shaft Extension: Single.
      4) RPM: 300 through 1250.
   b. Hydronic Fan Coil Unit:
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the fan coil unit and/or specified sequence of operation.
      3) Shaft Extension: Single.
      4) Options: User-interface.
      5) RPM: 300 through 1250.
   c. Package Terminal Air Conditioner (PTAC):
      1) Operating Mode: Constant speed.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the PTAC and/or specified sequence of operation.
      3) Shaft Extension: Single.
      4) Options: Resilient mounting.
      5) RPM: 600 through 1800.
   d. Power Roof Ventilator and Inline Centrifugal Fans (PRV):
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the PRV and/or specified sequence of operation.
      3) Shaft Extension: Single.
      4) Options: Remote mount control.
   e. Fan Powered Boxes (FPB):
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the PRV and/or specified sequence of operation.
      3) Shaft Extension: Single.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor installation.

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

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.03 FIELD QUALITY CONTROL FOR FIELD-INSTALLED MOTORS

A. Prepare for acceptance tests.
1. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
2. Verify bearing lubrication.
3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
4. Test interlocks and control and safety features for proper operation.
5. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:
1. Perform electrical tests and visual and mechanical inspections including optional tests and inspections stated in NETA ATS on factory- and field-installed motors. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.04 CLEANING

A. Comply with applicable requirements in Division 23 Section "HVAC Equipment Cleaning."

3.05 CONTRACTOR STARTUP AND REPORTING

A. Prepare for acceptance tests.
1. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
2. Verify bearing lubrication.
3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.

4. Test interlocks and control and safety features for proper operation.
5. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:
1. Perform electrical tests and visual and mechanical inspections including optional tests and inspections stated in NETA ATS on factory- and field-installed motors. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.06 DEMONSTRATION AND COMMISSIONING

A. Engage a factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain field-installed motors. Refer to Division 01 Section "Demonstration and Training."
1. Train maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, and maintaining chillers. The training will occur after the startup report has been provided and the trainer will provide two (2) Installation and Operations manuals for the use of the personnel during training.
2. Review data in maintenance manuals. Refer to Division 01. All required and recommended maintenance will be reviewed as well as operational trouble shooting. If the IOM does not include a written trouble shooting guide one will be provided.
3. Schedule training through Architect/Engineer of Record, with at least seven days' advance notice.

B. Demonstrate proper operation of equipment to commissioning agent or designated personnel. The scope of the demonstration will include functional performance requirements under both local and building automation control as well as any commissioning requirements in Division 01 or 23.

END OF SECTION 23 05 13

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Adhesive-backed duct markers.
D. Identification Signs
E. Warning Tags
F. Warning Signs and Labels

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
D. Product Data: Provide manufacturers catalog literature for each product required.
E. Samples: For color, letter style, and graphic representation required for each identification material and device.
F. Project Record Documents: Record actual locations of tagged valves.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store materials in a dry and secure area on-site and protect against dirt and moisture damage
B. Do not apply or install damaged materials.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Letter Color: White.
B. Letter Height: 1/4 inch.
C. Label Content: Include Project number, equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data. See sample equipment schedule at the end of Part 3.

2.02 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.03 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.
B. Style: Individual Label.

2.04 IDENTIFICATION SIGNS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches; 1/2 inch for viewing distances up to 72 inches; and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information, plus emergency notification instructions. Provide additional information as required.
J. Identification Signs are required for the following elements:
    1. “Gas Shut Off Valve” location at location of shut off button
    2. “Refrigerant Alarm” at alarm light outside of Chiller Room
    3. “Refrigerant Breathing Equipment” location near equipment locker or cabinet
    4. “Gas Usage Within Space” warning light adjacent to light outside of space
    5. “Emergency Boiler Shut Off” push button locations above buttons

2.05 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
    1. Size: Approximately 4 by 7 inches.
    2. Fasteners: Reinforced grommet and wire.
    3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
    4. Color: Safety yellow background with black lettering.

2.06 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: Yellow.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches; 1/2 inch for viewing distances up to 72 inches; and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information, plus emergency notification instructions. Provide additional information as required.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Install plastic pipe markers in accordance with manufacturer's instructions.
D. Equipment Label Installation
    1. Install or permanently fasten labels on each major item of mechanical equipment.
    2. Locate equipment labels where accessible and visible.
E. Duct Label Installation
    1. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 25 feet in each space where ducts are exposed or concealed by accessible ceilings.
    2. Duct Label Color Schedule (Background/Lettering Colors):
        a. Cold Supply Air: Blue Background, White Lettering
        b. Hot Supply Air: Yellow Background, Black Lettering
        c. Exhaust, Outside, Return, and Mixed Air: Green Background, White Lettering

F. IDENTIFICATION-SIGN INSTALLATION
G. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
    1. Identification Sign should be placed according to the equipment identified in paragraph 2.05-J above.
H. WARNING-TAG INSTALLATION
    1. Write required message on, and attach warning tags to, equipment and other items where required.

3.04 SAMPLE SCHEDULES

A. The following tables are examples of schedules required to be submitted by the Contractor. Example information has been included in the first row of the tables for reference only.

EQUIPMENT LABEL SCHEDULE				
EQUIPMENT IDENTIFICATION	**EQUIPMENT LOCATION**	**SPEC NUMBER**	**SPEC TITLE**	**REMARKS**
AHU-1	MECHANICAL ROOM M-215	23 XX XX	XX	MODULAR INDOOR AIR HANDLING UNITS

END OF SECTION 23 05 53

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, Adjusting, and Balancing.

D. TAB Firm: Entity responsible for performing and reporting TAB procedures.

E. TAB Specialist: Entity engaged by TAB Firm to perform TAB work.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods 2016.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).

D. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect/Engineer of Record.
2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
3. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect/Engineer of Record and other installers to sufficiently understand the design intent for each system.
4. Include at least the following in the plan:
    a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    d. Final test report forms to be used.
    e. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.

2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer of Record and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in I-P (inch-pound) units only.

E. Sample report forms. Submit two copies of the sample TAB report forms

F. Instrument calibration reports, including the following:
1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.05 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. TAB Conference: Prior to the start of the TAB work, and at Contractor's direction, coordinate a meeting at the Site to review the TAB strategies and procedures plan and to develop a mutual understanding of the details of the work involved. The meeting shall include the Architect/Engineer of Record, the Commissioning Authority (CxA) (if applicable), the TAB field supervisor, and the TAB technicians. Provide at least seven days' advance notice of meeting date and time.
1. Agenda Items:
a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.
e. Submittal distribution requirements.
f. Work Schedule and Project-Site requirements.
2. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, and those affected by decisions made.

C. Certification of TAB Reports: Certify TAB field data reports and perform the following:
1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB forms from NEBB or AABC as well as providing any additional information required by this specification.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE Std 111, Section 5, "Instrumentation."

F. The right to select at random 10% of the TAB report data for field verification witnessed by the commission agent. The TAB contractor will be given sufficient notice of the date of field verification. The same instruments that were used when the original test was recorded shall

be used. A failure of more than 10% of the selected field verification items shall result in a repeat of the testing of the entire system at the TAB contractor's expense. The repeated work is also subject to field verification.

1.06 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.07 WARRANTY

A. Provide warranty in accordance with AABC or NEBB standards:

1. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
2. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
3. Guarantee shall include the following provisions:
   a. The certified TAB firm has tested and balanced systems according to the Contract Documents.
   b. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

3.02 EXAMINATION

A. Examine the Contract Documents and field conditions to become familiar with Project requirements and to discover conditions that may preclude proper TAB of systems and equipment.

B. Examine the approved submittals for HVAC systems and equipment.

C. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
7. Fans are rotating correctly.
8. Fire and volume dampers are in place and open.
9. Terminal units, such as variable-air-volume boxes, are accessible and their controls are connected and functioning.
10. Air coil fins are cleaned and combed.
11. Access doors are closed and duct end caps are in place.
12. Air outlets are installed and connected.
13. Duct system leakage is minimized.
14. Hydronic systems are flushed, filled, and vented.
15. Pumps are rotating correctly.
16. Air has been eliminated from closed loop hydronic systems.
17. Proper strainer baskets are clean and in place.
18. Service and balance valves are open.
19. Installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers- verify that locations of these balancing devices are accessible and all required devices have been installed for proper balancing of the systems.

D. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

E. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide a TAB Plan that includes strategies and step-by-step procedures.

C. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer of Record to facilitate spot checks during testing.

D. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
C. Measure air quantities at air inlets and outlets.
D. Adjust fans to deliver the design air flow capacity at the design static pressure. Fan sheaves shall be replaced as necessary to obtain desired results. Provide all labor and material.
E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
F. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
G. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
H. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
I. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
J. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
K. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
L. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
M. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
N. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
O. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
P. On fan powered VAV boxes, adjust air flow switches for proper operation.
Q. Balance all individual air inlets and outlets.

3.07 MOTOR PROCEDURE

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
    1. Manufacturer's name, model number, and serial number.
    2. Motor horsepower rating.
    3. Motor rpm.
    4. Efficiency rating.
    5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.08 EXISTING SYSTEMS PROCEDURE

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer and within the limits of the motor HP. All fans shall deliver the design air flow capacity at actual static pressure up to design static. Fan sheaves shall be replaced as necessary to obtain desire results.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. Balance each air outlet.

3.09 TEMPERATURE CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
G. Check the interaction of electrically operated switch transducers.
H. Check the interaction of interlock and lockout systems.
I. Check main control supply-air pressure and observe compressor and dryer operations.
J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.10 TOLERANCES

A. Set HVAC system air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 5 percent.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.
C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
    a. System identification.
    b. Location.
    c. Coil identification.
    d. Capacity in kW
    e. Number of stages.
    f. Connected volts, phase, and hertz.
    g. Rated amperage.
    h. Air flow rate in cfm.
    i. Face area in sq. ft.
    j. Minimum face velocity in fpm.
2. Test Data (Indicated and Actual Values):
    a. Heat output in kW
    b. Air flow rate in cfm.
    c. Air velocity in fpm.
    d. Entering-air temperature in deg F.
    e. Leaving-air temperature in deg F.
    f. Voltage at each connection.

g. Amperage for each phase.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   1. Fan Data:
      a. System identification.
      b. Location.
      c. Make and type.
      d. Model number and size.
      e. Manufacturer's serial number.
      f. Arrangement and class.
      g. Sheave make, size in inches, and bore.
      h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   2. Motor Data:
      a. Motor make, and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches, and bore.
      f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
      g. Number, make, and size of belts.
   3. Test Data (Indicated and Actual Values):
      a. Total airflow rate in cfm.
      b. Total system static pressure in inches wg.
      c. Fan rpm.
      d. Discharge static pressure in inches wg.
      e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data:
      a. System and air-handling-unit number.
      b. Location and zone.
      c. Traverse air temperature in deg F.
      d. Duct static pressure in inches wg.
      e. Duct size in inches.
      f. Duct area in sq. ft.
      g. Indicated air flow rate in cfm.
      h. Indicated velocity in fpm.
      i. Actual air flow rate in cfm.
      j. Actual average velocity in fpm.
      k. Barometric pressure in psig.

H. Air-Terminal-Device Reports:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Apparatus used for test.
      d. Area served.
      e. Make.
      f. Number from system diagram.

g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):
a. Air flow rate in cfm
b. Air velocity in fpm
c. Preliminary air flow rate as needed in cfm
d. Preliminary velocity as needed in fpm
e. Final air flow rate in cfm
f. Final velocity in fpm
g. Space temperature in deg F

3.13 INSPECTIONS

A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made.
2. The TAB contractor's test and balance engineer shall conduct the inspection.
3. Shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall exhausters.

B. Inline centrifugal fans.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.

B. AMCA 99 - Standards Handbook 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.

J. UL 705 - Power Ventilators Current Edition, Including All Revisions.

K. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Provide wiring Diagrams: Power, signal, and control wiring.

D. Manufacturer's Instructions: Indicate installation instructions.

E. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

F. Maintenance Materials: Furnish the following for Board's use in maintenance of project.

1. Extra Fan Belts: One set for each individual fan.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.05 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
C. Lift and support units with manufacturer's designated lifting or supporting points.

1.07 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.
B. Operating Limits: Classify according to AMCA 99.

1.08 COORDINATION

A. Coordinate size and location of structural-steel support members.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.09 EXTRA MATERIALS

A. Furnish one set of belts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation: www.greenheck.com
B. Loren Cook Company: www.lorencook.com

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.
B. In general, direct drive fans with ECM motors/speed controller are preferred over belt drive fans.
C. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
D. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
E. Fabrication: Comply with AMCA 99.
F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
G. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.
H. Hazardous/Fume Hood exhaust and Natatorium exhaust shall have corrosion resistant coating.
I. Motors and Electrical Accessories: Comply with the requirements of NEMA standards.

2.03 WALL EXHAUSTERS

A. Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 1/2 inch mesh, 0.062 inch thick aluminum wire bird screen.
B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
C. NEMA 3R Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.
D. Direct drive motor assembly with ECM motor and variable speed controller.
E. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
F. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

2.04 INLINE CENTRIFUGAL FANS AND BLOWERS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor.

B. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
C. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
D. Direct drive motor assembly with ECM motor and variable speed controller.
E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and FPDCC standard mechanical details.
B. Install units with clearances for service and maintenance.
C. Install power ventilators level and plumb.
D. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
E. Extend ducts to roof exhausters into roof curb. Counter flash duct to roof opening.
F. Install floor-mounting units on concrete bases.
G. Hung Cabinet Fans:
    1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment.
    2. Install flexible connections specified in Section 23 33 00 - Air Duct Accessories between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
H. Provide sheaves required for final air balance.
I. Install dampers on inlet to roof and wall exhausters in accordance with FPDCC standard mechanical details.
J. Provide dampers on outlet from cabinet and ceiling exhauster fans and in accordance with FPDCC standard mechanical details.

3.02 ADJUSTING

A. Adjust damper linkages for proper damper operation.
B. Adjust belt tension.
C. Refer to Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC for testing, adjusting, and balancing procedures.
D. Replace fan and motor pulleys as required to achieve design airflow.
E. Lubricate bearings.

3.03 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
    1. Verify that shipping, blocking, and bracing are removed.
    2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
    3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

D. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.05 CONTRACTOR STARTUP AND REPORTING

A. Final Checks before Startup: Perform the following operations and checks before startup. Startup service includes the testing, inspections and startup test reports:
1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.
7. Disable automatic temperature-control operators.

B. Starting procedures for fans are as follows:
1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
2. Measure and record motor voltage and amperage.

C. Shut unit down and reconnect automatic temperature-control operators.

D. Refer to Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC for procedures for air-handling-system testing, adjusting, and balancing.

E. Replace fan and motor pulleys as required to achieve design conditions.

3.06 DEMONSTRATION AND COMMISSIONING

A. Engage a factory-authorized service representative to train Board's maintenance personnel to adjust, operate, and maintain the fans.
1. Train Board's maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, and maintaining fans. The training will occur after the startup report has been provided to the Board and the trainer will

provide two (2) Installation and Operations manuals for the use of the Board's personnel during training.

2. Review data in maintenance manuals. Refer to Division 01. All required and recommended maintenance will be reviewed as well as operational trouble shooting. If the IOM does not include a written trouble shooting guide one will be provided.
3. Schedule training with Board, through Architect/Engineer of Record, with at least seven days' advance notice.

B. Demonstrate proper operation of equipment to commissioning agent or designated Board personnel. The scope of the demonstration will include functional performance requirements under both local and building automation control as well as any commissioning requirements in Division 01 and 23.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Door and transfer grilles.

1.02 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2011 with Addendum 1.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to material, size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, pressure drop, throw velocity, and noise level.

C. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members to which roof curbs and ventilators will be attached.
   2. Sizes and locations of roof openings.

1.04 QUALITY ASSURANCE

A. AHRI Compliance: Test and rate diffusers, registers, and grilles in accordance with AHRI 880 (I-P).

B. ASHRAE Compliance: Test and rate diffusers, registers, and grilles in accordance with ASHRAE Std 70.

C. ADC Compliance: Test and rate diffusers, registers, and grilles in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".

D. ADC Seal: Provide diffusers, registers, and grilles bearing ADC Certified Rating Seal.

E. NFPA Compliance: Install diffusers, registers, and grilles in accordance with NFPA 90A.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final locations, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.06 WARRANTY

A. Provide warranty on materials and labor for 18 months starting from date of delivery, or one year from date of substantial completion, whichever is longer.

PART 2 - PRODUCTS

2.01 GENERAL APPLICATION INFORMATION

A. In general, diffusers, registers, and grilles shall be constructed of steel with color as selected by AOR/EOR.

B. For wet environments, all diffusers, registers, and grilles shall be constructed of aluminum.

C. For harsh and/or corrosive environments such as natatorium, diffusers, registers, and grilles shall be provided with a complete corrosion resistant coating applicable to the environment where installed.

2.02 MANUFACTURERS

A. Diffusers, Registers, and Grilles
1. Titus: www.titus-hvac.com.
2. Price Industries: www.price-hvac.com.
3. Tuttle and Bailey: www.tuttleandbailey.com/sle.
4. Nailor

2.03 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, stamped, multi-core diffuser to discharge air in 360 degree, one way, two way, three way, and four way pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As selected by Architect/Engineer of Record from manufacturer's standard range.

2.04 PERFORATED FACE CEILING DIFFUSERS (RETURN/EXHAUST APPLICATION ONLY)

A. Type: Perforated face with fully adjustable pattern and removable face.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with baked enamel finish.

D. Color: As selected by Architect/Engineer of Record from manufacturer's standard range.

2.05 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Construction: Made of steel with factory enamel finish.

D. Color: As selected by Architect/Engineer of Record from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face. To be used for inaccessible hard ceiling applications only.

2.06 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect/Engineer of Record from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans. To be used for inaccessible hard ceiling applications only.

2.07 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect/Engineer of Record from manufacturer's standard range.

E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.08 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: To be selected by Architect/Engineer of Record from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.09 DOOR AND TRANSFER GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Construction: Outer borders shall be constructed of heavy extruded aluminum and shall have countersunk screw holes for a neat appearance. Border shall be interlocked at the four corners and mechanically staked to form a rigid frame. Extruded aluminum inverted V-blades with a deflection shall be used to create a sight proof design and provide additional stiffness to the grille.

D. Types: Provide wall grilles of type, capacity, and with accessories and finishes as listed on schedule.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install intake and relief ventilators level, plumb, and at indicated alignment with adjacent work.

C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels,

locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

D. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

E. Secure intake and relief ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible

F. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

G. Install diffusers to ductwork with air tight connection.

H. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

3.02 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.03 CONTRACTOR STARTUP AND REPORTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 00

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cabinet unit heaters.

1.02 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addendum (2011).
B. AHRI 440 - Performance Rating of Room Fan-Coils 2008.
C. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter 1992 Edition.
D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Errata (2020).
E. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
H. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
M. UL 2021 - Fixed and Location Dedicated Electric Room Heaters Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
    1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
    2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work
    3. Require attendance by all affected installers including but not limited to
        a. Contractor's Superintendent
        b. Installer
        c. Manufacturer/Fabricator Representative
        d. Other affected Subcontractors
        e. Architect/Engineer of Record
    4. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record and those affected by decisions made.
B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements, fan curves, sound levels, etc.
C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
   3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified cooling or heat required to actual cooling or heat output provided.
   4. Indicate mechanical and electrical service locations and requirements.
D. Selection Samples: For each finish product specified, color chart representing manufacturer's full range of available colors.
E. Verification Samples: For each finish product specified, color chip representing actual product in color and texture.
F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
G. Warranty: Submit manufacturer's warranty and ensure forms have been completed with name and registered with manufacturer.
H. Maintenance Materials: Furnish the following use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Filters: One set of each type and size.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
B. Comply with minimum COP/efficiency levels according to ASHRAE Std 90.1 I-P.

1.06 DELIVERY, STORAGE AND HANDLING

A. Units shall be stored and handled in accordance with manufacturer’s instructions.
B. Protect units from damage and construction debris before installation. Cover open pipe ends during shipping and storage at the construction site.
C. Coils:
   1. Comply with ASHRAE Std 62.1, Section 7 (practices to be followed during construction and startup). Protect equipment from rain and other sources of moisture by appropriate in-transit and on-site procedures.
   2. Follow manufacturer’s recommendations for handling, unloading and storage.
   3. Seal openings to protect against damage during shipping, handling and storage.
   4. Provide shrink-wrap around entire exterior of coil. The membrane shall cover the entire coil to fully protect it during shipping and storage.
   5. Storage: Store per manufacturer’s written recommendations. Store coils indoors in a warm, clean, dry place where the units will be protected from weather, construction traffic, dirt, dust, water and moisture.

1.07 COORDINATION

A. For cabinet unit heaters and fan coils that penetrate or are supported by the ceiling, coordinate layout and installation of units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate layout and installation of unit ventilators and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
C. Coordinate size and location of wall sleeves for outdoor-air intake and relief dampers.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Provide warranty on materials and labor for 18 months starting from date of delivery, or one year from date of Preliminary Acceptance, whichever is longer.
C. Special Warranty Period for Compressors: Manufacturer's standard, but not less than five (5) years from date of Preliminary Acceptance. Parts-Only warranty is not acceptable.

PART 2 - PRODUCTS

2.01 UNIT HEATERS

A. Manufacturers:
1. Airtherm, a Mestek Company: www.airthermhvac.com
2. Dunham Bush: www.dbamericas.com
3. Modine Manufacturing Company: www.modineHVAC.com
4. Sterling Hydronics, a Mestek Company: www.sterlingheat.com
5. Vulcan Radiator: www.vulcanrad.com
6. Airtherm

B. Comply with UL 2021.
C. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubing. Minimum 2 row coils.
1. Evenly spaced aluminum fins mechanically bonded to copper tubes. Minimum 2 row coils.
2. Electric Units Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Electric Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.
4. Heating Hot Water: Suitable for working temperatures up to a maximum not less than 200 degrees F.
5. Steam: Suitable for low pressure steam <15 psi.

D. Perform factory run test under normal operating conditions, water, and steam flow rates.
E. Casing: Minimum 18 gauge, 0.0478 inch thick sheet steel casing with threaded pipe connections for hanger rods for horizontal models and minimum 18 gauge, 0.0478 inch thick sheet steel top and bottom plates for vertical projection models.
F. Finish: Factory applied baked primer coat.
G. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
H. Air Outlet: Adjustable pattern diffuser on vertical projection models and two way louvers on horizontal projection models.
I. Control: Local disconnect switch with remote mounted 7-day programmable thermostat.
1. Provide aquastat and 2-position solenoid valve (hot water).
2. Programmable night setback.
3. Lockable cover with tamper proof screws.

4. Low voltage relays and control transformers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Unit Heaters:

1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
3. Provide temperature controls.
4. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls unless otherwise noted.
5. Ground equipment according to Section 26 05 26 - Grounding and Bonding for Electrical Systems.
6. Connect wiring according to Section 26 05 83 - Wiring Connections.

E. Cabinet Unit Heaters:

1. Coordinate to ensure correct recess size for recessed units.
2. Install new filters in each unit within two weeks of Substantial Completion.
3. Install remote thermostats 5' above finished floor.
4. Install piping adjacent to unit to allow service and maintenance.
5. Provide temperature controls.
6. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls unless otherwise noted.
7. Ground equipment according to Section 26 05 26 - Grounding and Bonding for Electrical Systems.
8. Connect wiring according to Section 26 05 83 - Wiring Connections.

3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

D. Install new filters.

END OF SECTION 23 82 00

SECTION 26 05 05

SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 - GENERAL

PART 2 -

2.01 SECTION INCLUDES

A. Electrical demolition.

2.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 3 - PRODUCTS

3.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 4 - EXECUTION

4.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Architect/Engineer of Record before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

4.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Board at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Board before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.
   5.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Board at least 24 hours before partially or completely disabling system.
   2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
   3. Make temporary connections to maintain service in areas adjacent to work area.

4.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

4.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 05 05

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Service entrance cable.

C. Wiring connectors.

1.02 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.

G. NFPA 70 - National Electrical Code; 2017.

H. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

I. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

J. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

K. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. See Section 01 33 29 - LEED Sustainable Design Reporting, when required.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
1. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
2. Tinned Copper Conductors: Comply with ASTM B33.

H. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
3. Color Code:
   a. Equipment Ground, All Systems: Green.

2.02 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:
   a. Size 12 AWG and Smaller: Solid.
   b. Size 10 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.03 SERVICE ENTRANCE CABLE

A. Conductor Stranding: Stranded.

B. Insulation Voltage Rating: 600 V.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

D. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

E. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

F. Install conductors with a minimum of 12 inches of slack at each outlet.

G. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

H. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

I. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

J. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

K. Insulate ends of spare conductors using vinyl insulating electrical tape.

L. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.

M. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.
   1. Equipment grounding.
   2. Wiring device grounding.
   3. Panelboard grounding.
   4. Isolated grounding.

B. Conductors for grounding and bonding.

1.02 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

C. Municipal Code of the Local authority, Building/Electrical Code Requirements; 2018.

D. IEEE 1100 - IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment; 2005.

E. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

G. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

H. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2017.

I. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev C, 2015.

J. TIA-942 - Telecommunications Infrastructure Standard for Data Centers; 2017.

K. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

L. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each type of component for grounding and bonding system(s).

C. Shop Drawings:
   1. Plans showing dimension as-built locations of grounding features, including the following:
      a. Ground rods.
      b. Grounding arrangements and connections for separately derived systems.
      c. Grounding for sensitive electronic equipment.
   2. Grounding rod and ground loop locations.
   3. Grounding arrangements and connections for separately derived systems.
   4. Grounding for sensitive electronic equipment.

D. Field quality control test reports with indication of overall resistance to ground.

E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

F. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
   1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS.
      a. Periodic testing and inspection shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
      b. Include recommended testing intervals.

1.05 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: An organization recognized by OSHA regulation 1910.7 as a Nationally Recognized Testing Laboratory (NRTL) and as defined in the Local authority Electrical Code, Article 100.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Conform with UL 467 for grounding and bonding materials and equipment

D. Conform with Local authority Electrical Code.

E. Installer Qualifications: Electrical contractor approved for installation and termination of the main bonding conductor to the building service entrance ground.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

G. Follow IEEE 1100 - Recommend Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book).

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by the Local authority Electrical Code and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with the Local authority Electrical Code but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect/Engineer of Record. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not to exceed the values set forth to ground as indicated in part 3.03 of this specification, when tested according to IEEE 81 using the "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with the Local authority Electrical Code.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with the Local authority Electrical Code.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
   7. Provide bonding for interior metal piping systems in accordance with the Local authority Electrical Code. This includes, but is not limited to:
      a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
      b. Metal gas piping.
      c. Metal process piping.
   8. Provide bonding for interior metal air ducts.
   9. Provide bonding for metal building frame.

10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with the Local authority Electrical Code.
12. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

G. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated equipment grounding conductors.
2. Connect isolated equipment grounding conductors only to separate isolated equipment ground busses.
3. Connect the isolated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.
4.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26 - Grounding and Bonding for Electrical Systems.
1. Use insulated copper conductors unless otherwise indicated.
    a. Exceptions:
        1) Use bare copper conductors where installed underground in direct contact with earth.
        2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Equipment Grounding Conductors: Insulated with green color insulation.
3. Grounding-Electrode Conductors: Stranded cable.
4. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
5. Insulated Conductors: Wire or cable insulated for 600V unless otherwise required by applicable code or authorities having jurisdiction.
6. Bare Copper Conductors:
    a. Solid Conductors: ASTM B3.
    b. Stranded Conductors: ASTM 8.
    c. Tinned Conductors: ASTM B33.
    d. Bonding Cable: 28kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
    e. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
    f. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
    g. Bonding Straps: Soft copper, 0.05 inch think and 2 inches wide, except as indicated.
    h. Cable assemblies shall be UL listed and CSA certified.
    i. Cables shall be a distinctive green (equipment ground) or green/yellow tracer (isolated ground) in color, and all jackets shall be UL, VW-1 flame rated.

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors or exothermic welded connections for accessible connections.
4. Mechanical Connectors: Copper or copper alloy, bolted pressure-type, with at least two bolts.
    a. Heavy Duty Pipe Clamps: Pipe clamps shall be high copper alloy or cast bronze with silicon bronze threaded fasteners; saddle type designed for the size of conductor indicated or required by Contract Documents.
    b. Beam Clamps: Beam clamps shall be compression type; heavy duty bronze construction; provide a minimum of 8 square inches of bonding surface; and designed for copper rope-lay cable.
    c. Grounding Bushing: Groundings bushings shall be malleable iron, threaded, with insulated liner and solderless lug.
5. Pressure Connectors: High-conductivity plated units.
6. Terminating Lugs: Exothermic weld or crimp compression type.
7. Manufacturers - Mechanical and Compression Connectors:
    a. Burndy LLC: www.burndy.com.
    b. Harger Lightning & Grounding: www.harger.com.
    c. Thomas & Betts Corporation: www.tnb.com.
    d. NSI Industries; www.nsiindustries.com.
8. Manufacturers - Exothermic Welded Connections:
    a. Burndy LLC: www.burndy.com.
    b. Cadweld, a brand of Erico International Corporation: www.erico.com.
    c. Cadweld, a brand of Erico International Corporation; www.erico.com.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions and the Local authority Electrical Code.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, provide ground plates.
    1. Outdoor and Indoor Installations: Unless otherwise indicated, install with top of rod 2 inches below finished grade.
        a. Verify all conditions prior to initiation of work.
        b. Verify final backfill and compaction are complete before driving rod electrodes.
        c. Do not expose steel or damage coating, if any, on interconnection of ground rods with grounding electrode conductors

d. Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to service grounding electrode conductor.

E. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Bond straps directory to structure without penetrating adjacent parts.
4. Install bonding to equipment mounted on vibration isolators so any vibration from equipment is not transmitted to any other equipment, devices, fixtures, and/or structure.
5. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
8. Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building.
   a. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange.
   b. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting.
   c. Bond metal grounding conductor conduit or sleeve to conductor at each end.
9. Use braided-type bonding jumpers at water meter piping to electrically bypass water meters. Connect to pipe with a bolted connector.
10. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Identify grounding and bonding system components in accordance with Section[]26 05 53 - Identification for Electrical Systems.

G. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connector for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

H. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Restore surface features, including vegetation, at areas disturbed by work of this Section including but not limited to:

1. Re-establish original grades, except as otherwise indicated.
2. Where sod has been removed, replace it as soon as possible after backfilling has been completed.
3. Restore areas disturbed by trenching of dirt, cable laying, and other activities to their original condition.
    a. Include trenching, storing of dirt, cable laying, and other areas to their original condition.
    b. Include top soiling, fertilizing, liming, sodding, sprigging, and mulching.
4. Restore disturbed paving as indicated or to original condition prior to the initiation of work of this Section.

C. Perform the following tests and inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells and at individual ground rods. make tests at ground rods before any conductors are connected.
    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
    c. Perform tests by fall-of-potential method according to IEEE 81.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements or exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10ohms.
2. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3ohms.
3. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
4. Substations and Pad-Mounted Equipment: 5 ohms.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

F. If resistance to exceeds specified values, notify Architect/Engineer of Record immediately with inclusion of recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical systems and work.

B. Construction requirements for concrete bases.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

H. Local authority Electrical Code - Municipal Code of the Local authority, Building/Electrical Code Requirements; 2018.

I. MFMA-4 - Metal Framing Standards Publication; 2004.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

L. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

M. NFPA 70 - National Electrical Code; 2017.

N. SSPC-PA 1 - Shop, Field, and Maintenance Painting of Steel; 2004.

O. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Install floor-mounted electrical equipment on a minimum of 4 inch concrete housekeeping pad, with a minimum of 4 inches of equipment inset on all sides. Concrete shall be in accordance with Section 03 30 00 - Cast-in-Place Concrete.
   6. Provide steel supports, anchor bolts, inserts, etc., for all equipment specified under this section of the specifications.
   7. Provide formed steel support channels extending from and solidly anchored to the floor and ceiling slabs and mount the designated equipment thereto.
   8. Coordinate installation of roof curbs, equipment supports, and roof penetrations specified under Section 07 72 00 - Roof Accessories.
   9. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
   10. Provide concrete pads for:
      a. Switchboards.
      b. Transformers.
   11. Provide steel support channels for:
      a. Communication and special systems cabinets.
      b. Disconnect switches.
      c. Fire alarm system cabinets.
      d. Individual motor starters.
      e. Individual circuit breakers.
      f. Panelboards.
      g. Wall mounted transformers.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00 - Cast-in-Place Concrete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualification Statement: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with the Local authority Electrical Code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualification for Field-Welding: Procedures and personnel according to AWS D1.1/D1.1M

D. Manufacturer's Qualifications: Company specializing in manufacturing products specified in this Section with a minimum three years' experience.

E. Listing and Labeling: Provide products specified in this section that are listed and labeled.

F. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

G. Product Listing Organization Qualifications: An organization recognized by OSHA Regulation 1910.7 as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and in original packaging.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:

E. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   4. Plastic and lead anchors are not permitted.
   5. Powder-actuated fasteners are permitted only as follows:
      a. Use only threaded studs; do not use pins.
         1) Threaded-heat-treated steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used..
   6. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Comply with MFMA-4 or MSS SP-58.
      b. Channel Material: Use Steel or malleable-iron, slotted support system units similar to MSS Type 18..
      c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
   7. Manufacturers - Mechanical Anchors:
      a. Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
         1) Hilti, Inc.: www.us.hilti.com.
         2) ITW Red Head, a division of Illinois Tool Works, Inc.: www.itwredhead.com.
         3) Cooper B-Line, a division of Eaton Corporation; www.cooperindustries.com.
         4) Empire Tool and Manufacturing Company; www.empireindustries.com
         5) MKT Fastening, LLC; www.mktfastening.com
   8. Manufacturers - Powder-Actuated Fastening Systems:
      a. Hilti, Inc.: www.us.hilti.com.
      b. ITW Ramset, a division of Illinois Tool Works, Inc.: www.ramset.com.
      c. Simpson Strong-Tie Company Inc.: www.strongtie.com.
      d. MKT Fastening, LLC; www.mktfastening.com.

F. Clamps (attachment to steel structural elements):
   1. MSS SP-58, suitable for attached structural element.

G. Through Bolts:
   1. Structural type, hex head, and high strength.
   2. Comply with ASTM A325.

H. Toggle Bolts:
   1. All-steel springhead type.

I. Hanger Rods:
   1. Threaded steel.

2.02 VIBRATION ISOLATORS

A. General: Provide vibration isolators with either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
   1. Provide isolators that operate in the linear portion of their load versus deflection curve. Furnish load versus deflection curves from the manufacturer that are linear, over a deflection range 50% above the design deflection.

B. Manufacturers:
   1. California Dynamics Company; www.caldyn.com
   2. Mason Industries: www.mason-ind.com

C. Vibration Isolator Types:
   1. General Properties:
      a. The ratio of lateral to vertical stiffness shall be not less than 0.9 or greater than 1.5.
      b. The theoretical vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than (+/-) 10%.
      c. Wave motion through the isolator shall be reduced to the following extent: Isolation above the primary vertical system resonance frequency shall follow the theoretically predicted isolation curve for single degree of freedom systems with 1-dB to 50 dB at all frequencies above the 150 Hz.
      d. All neoprene mountings shall have a shore hardness of 40 -65 after minimum aging of 30 days, or corresponding open-aging.
   2. Isolator Description:
      a. Type MS shall be spring type, without housings or snubbers, equipped with leveling bolts and with two layers of ribbed or waffled neoprene pads, separated by a 1/16” galvanized steel plate under the base plate. Neoprene sleeves and washer shall be installed at all anchor bolts.
      b. Type HS shall be suspension hangers having a steel frame and spring element, in series with a neoprene pad, cut or washer. The isolator shall be designed so that hanger rod may be misaligned 15 degrees in any direction relative to the vertical, without contacting hanger box frame.
      c. Type MN shall be neoprene isolator support type unit having a minimum static deflection of ¼”.
      d. Type HN shall be a suspension hanger type employing a neoprene isolator unit having a minimum static deflection of ¼”.

D. Equipment Frames
   1. Mounting frames and brackets shall be provided to carry the load of the equipment without causing mechanical distortion or stress to the equipment.
   2. The mounting frames shall consist of welded, wide flange or channel structural steel, with welder brackets to accept the isolators. The section depth of any frame member shall be not less than 1/10th of the length of the longest frame member, and not less than 1/10th of the greatest span between support points. All frame members shall have the same depth.

2.03 MANUFACTURERD SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps as described in NECA 1 and NECA 101.

B. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

C. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs shall have number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish. Provide OZ/Gedney type “S” cable support or equal.

D. U-Channel Systems: 12-gauge steel channels, with 9/16 inch diameter holes, at a minimum of 2 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

2.04 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 50 00 - Metal Fabrications for steel shapes and plates.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
      a. 3 inch and smaller: 2 gauge.
      b. 4 inch to 6 inch: 16 gauge.
      c. Over 6 inch: 14 gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
   3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1 and .NECA 101

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect/Engineer of Record, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect/Engineer of Record, do not provide support from roof deck.

F. RMC, IMC, and EMT may be supported by openings through structure members, as permitted in the Local authority Electrical Code.

G. Minimum static design load used for strength of support assemblies shall be weight of supported components plus 200 pounds.

H. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

I. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations 1 inch off of wall or surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
   5. To Wood: Fasten with lag screws or through bolts.
   6. To New Concrete: Bolt to concrete inserts.
      a. Do not penetrate water proofing.
   7. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   8. To Existing Concrete: Expansion anchor fasteners.
      a. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   9. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts Spring-tension clamps.
      a. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.

10. To Light Steel: Sheet metal screws.
11. Fasteners: Select so the load applied to each fastener does not of its proof test load.
12. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration and shock-resistant fasteners for attachments to concrete slabs.
13. Provide weight-distributing facilities, where required, so as not to exceed the load-bearing capabilities of floors or walls that bear the weight of, or support, electrical systems.
14. Exposed part of hangers and supports shall be painted with one coat of rust-inhibiting primer.
15. Equipment shall not be held in place by its own dead weight. Provide base anchor fasteners in each case.
16. Miscellaneous Supports: Support miscellaneous electrical components as required to provide the same structural safety factors as specified for raceway supports. Install metal channel or angle iron racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

J. Conduit Support and Attachment: Also comply with Section 26 05 33.13 - Conduit for Electrical Systems.

K. Box Support and Attachment: Also comply with Section 26 05 33.16 - Boxes for Electrical Systems.

L. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00 - Interior Lighting.

M. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00 - Exterior Lighting.

N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O. Overhead boxes shall be supported independently of associated raceways.

P. Secure fasteners according to manufacturer's recommended torque settings.

Q. Remove temporary supports.

R. Concrete Bases:
1. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
2. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 - Cast-in-Place Concrete.
3. Anchor equipment to concrete base.
    a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Install anchor bolts to elevations required for proper attachment to supported equipment.
    c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

S. Installation of Fabricated metal Supports:

1. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
2. Comply with installation requirements in Section 05 50 00 - Metal Fabrications for site-fabricated metal supports.
3. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
4. Field Welding: Comply with AWS D1.1/D1.1M.

3.03 SCHEDULE, TABLE 1: SPACING FOR RACEWAY SUPPORTS:

*** Maximum spacing for IMC above apply to straight runs only. Otherwise the maximums for EMT appl**

RACEWAY SIZE (INCHS)	NO. OF CONDUCTORS IN RUN		MAXIMUM SPACING OF SUPPORTS (FEET) FOR RGS AND IMC	MAXIMUM SPACING OF SUPPORTS (FEET) FOR EMT
HORIZONTAL RUNS				
1/2, 3/4	1 or 2	Flat ceiling or wall	5	5
1/2, 3/4	1 OR 2	Where limited to support by building construction.	7	7
1/2, 3/4	3 or more	Any location	7	7
1/2-1	3 or more	Any location	7	7
1 and larger	1 or 2	Flat ceiling or wall	6	6
1 and larger	1 or 2	Where limited to support by building construction.	10	10
1 and larger	3 or more	Any location	10	10
Any	-	Concealed	10	10
VERTICAL RUNS				
1/2, 3/4	-	Exposed	7	7
1, 1 1/4	-	Exposed	8	8
1 1/2 and larger	-	Exposed	10	10
Up to 2	-	Shaftway	14	10
2 1/2	-	Shaftway	16	10
3 and larger	-	Shaftway	20	10
Any	-	Concealed	10	10

*** Maximum spacing for IMC above apply to straight runs only. Otherwise the maximums for EMT apply.**

A. Abbreviations:
   1. EMT:
   2. IMC:
   3. RGS:

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

3.05 CLEANING AND PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
2.

B. Touchup: Comply with requirements in Section 09 91 23 - Interior Painting for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

END OF SECTION 26 05 29

SECTION 26 05 33.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Aluminum rigid metal conduit (RMC).

C. Intermediate metal conduit (IMC).

D. Flexible metal conduit (FMC).

E. Liquidtight flexible metal conduit (LFMC).

F. Electrical metallic tubing (EMT).

G. Rigid polyvinyl chloride (PVC) conduit.

H. Conduit fittings.

I. Accessories.

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.

D. Municipal Code of the Local authority, Building/Electrical Code Requirements; 2018.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.

H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.

I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.

L. NFPA 70 - National Electrical Code; 2017.

M. TIA-569-D - Telecommunications Pathways and Spaces; Rev D, 2015.

N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

P. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

S. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

T. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

U. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
1. Indicate each type and size of conduit to be utilized within project.
2. Indicate each type and size of conduit fitting to be utilized within project.

C. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch trade size and larger.

1.05 QUALITY ASSURANCE

A. Comply with NECA's "Standard of Installation".

B. Comply with the Local authority Electrical Code.

C. Product Listing Organization Qualifications: An organization recognized by OSHA Regulation 1910.7 as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Effectively protect all materials, accessories, and components from any damage or injury from the time of fabrication until final acceptance.

C. Store equipment in spaces with environments controlled within manufacturer's ambient temperature and humidity tolerances for non-operating equipment.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by the Local authority Electrical Code and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
1. Under Slab on Grade: Use galvanized steel rigid metal conduit.
2. Exterior, Direct-Buried: Use rigid PVC conduit where permitted by the Local authority Electrical Code..
3. Service Entrance: Use galvanized steel rigid metal conduit.
4. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit.
5. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
6. Where rigid polyvinyl (PVC) conduit larger than 2 inch trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
7. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection.
8. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit.

2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit.
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit.

E. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H. Exposed, Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
1. Locations subject to physical damage include, but are not limited to:
a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
b. Loading dock..
c. Mechanical rooms.

K. Exposed, Exterior: Use intermediate metal conduit (IMC).

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use intermediate metal conduit (IMC).

M. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit.

N. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
1. Maximum Length: 6 feet.

O. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.

2.02 CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 26 21 00 - Low-Voltage Electrical Service Entrance.

B. Communications Systems Conduits: Also comply with Section 27 10 00 - Structured Cabling.

C. Fittings for Grounding and Bonding: Also comply with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
1. 3/4-inch trade size..

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

H. Where conduit size is not indicated, size to comply with the Local authority Electrical Code but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Wheatland Tube Company: www.wheatland.com/#sle.
3. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com.
4. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com

B. Description: The Local authority Electrical Code, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Wheatland Tube Company: www.wheatland.com/#sle.
3. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com.
4. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com

B. Description: The Local authority Electrical Code, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. Allied Tube & Conduit; www.alliedeg.com..
2. Wheatland Tube Company; www.wheatland.com.
3. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com.
4. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com

B. Description: The Local authority Electrical Code, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. Allied Tube & Conduit; www.alliedeg.com..
2. Wheatland Tube Company; www.wheatland.com.
3. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com.
4. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com

B. Description: The Local authority Electrical Code, type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com.
2. Wheatland Tube Company: www.wheatland.com.
3. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com.
4. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Description: The Local authority Electrical Code, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

D. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.
3. Connectors and Couplings: Use compression (gland) type with insulated throat.
a. Do not use indenter type connectors and couplings.
b. Do not use set-screw type connectors and couplings.
4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Electri-Flex Company; www.electriflex.com.
2. Hubbell Company, RACO products; www.hubbell-rtb.com
3. CertainTeed Pipe and Plastics; www.certainteed.com

B. Description: The Local authority Electrical Code, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
   1. Electri-Flex Company: www.electriflex.com/#sle.
   2. Hubbell Company, RACO products; www.hubbell-rtb.com.
   3. CertainTeed Pipe and Plastics; www.certainteed.com

B. Description: The Local authority Electrical Code, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.10 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

I. Conduit Routing:
   1. Unless dimensioned, any conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Protect stub-ups from damage where conduits rise through floor slabs. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
   9. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
      a. For Telecommunications conduit, fewer bends are allowed.
   10. Arrange conduit to provide no more than 150 feet between pull points.
      a. For Telecommunications conduit, install pull boxes every 100 feet.
   11. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plan and straight legs of offsets parallel, unless otherwise indicated.
      a. Use raceway fittings compatible with raceways and suitable for use and location.
      b. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
   12. Route conduits above water and drain piping where possible.
   13. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   14. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   15. Maintain minimum clearance of 6 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.

16. Group parallel conduits in the same area together on a common rack.

J. Conduit Support:
1. Secure and support conduits in accordance with the Local authority Electrical Code and Section 26 05 29 - Hangers and Supports for Electrical Systems, using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit 1 1/2 inch and smaller from beam clamp or threaded rod and for fastening raceways to trapeze supports.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
   a. Sized so capacity can be increased by 25 percent in future without exceeding specified design load limits.
   b. Secure raceways and cables to supports with single-bolt conduit clamps.
8. Use of spring steel conduit clips for support of conduits is not permitted.
9. Use of wire for support of conduits is not permitted.

K. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

L. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.
10. Install sealing fittings in suitable, approved, and accessible locations.
    a. Install in flush steel box with blank cover plate.
        1) Finish similar to adjacent plates or surfaces.
    b. Install at the following locations:
        1) Where conduits pass from warm to cold locations.
        2) Where required by the Local authority Electrical Code.

M. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 23 16 - Excavation and Section 31 23 23 - Fill.
2. Minimum Cover, Unless Otherwise Indicated or Required:
    a. Underground, Exterior: 24 inches.
    b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 26 05 53 - Identification for Electrical Systems along entire conduit length.

N. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.

O. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

P. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with the Local authority Electrical Code.

Q. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

R. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

S. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave minimum slack of 12 inches at each end.

T. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

U. Voice and Data System Raceways, 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways in maximum lengths of 100 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements. Provide insulating bushings at all terminations. Comply with EIA/TIA-569-D.
   1. Conduit to be color coded for Voice and Data systems in accordance with Section 26 05 53 - Identification for Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

C. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 05 33.13

SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes for hazardous (classified) locations.

D. Floor boxes.

1.02 REFERENCE STANDARDS

A. Municipal Code of the Local authority, Building/Electrical Code Requirements; 2018.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

H. NFPA 70 - National Electrical Code; 2017.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; 2013.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

N. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by the Local authority Electrical Code.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to the Local authority Electrical Code.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to the Local authority Electrical Code.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for junction boxes, pull boxes, cabinets and enclosures, and floor boxes.

1.05 QUALITY ASSURANCE

A. Comply with Local authority Electrical Code.

B. Comply with NECA's "Standard of Installation".

C. Product Listing Organization Qualifications: An organization recognized by OSHA Regulation 1910.7 as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by the Local authority Electrical Code.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. here box size is not indicated, size to comply with the Local authority Electrical Code but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
6. Use suitable concrete type boxes where flush-mounted in concrete.
7. Use suitable masonry type boxes where flush-mounted in masonry walls.
8. Use raised covers suitable for the type of wall construction and device configuration where required.
9. Use shallow boxes where required by the type of wall construction.
10. Do not use "through-wall" boxes designed for access from both sides of wall.
11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
16. Wall Plates: Comply with Section 26 27 26 - Wiring Devices.
17. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Hubbell Incorporated; : www.hubbell-rtb.com.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com.
    d. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    e. Appleton Electric, a brand of Emerson Corporation; www.emersonindustrial.com
    f. Walker Systems, a part of Wiremold, a brand of Legrand; www.legrand.us .
    g. Hoffman, a brand of Pentair Technical Products; www.hoffmanonline.com

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide hinged-cover enclosures unless otherwise indicated.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Removable interior panel and removable front.

b. Hinged door in front cover with flush latch and concealed hinge.
c. Keyed latch to match panelboards.
d. Metal barriers to separate wiring of different systems and voltages.
e. Accessory feet where required for freestanding equipment.

5. Finish for Painted Steel Enclosures: Finished inside and out with manufacturer's standard enamel. unless otherwise indicated.
6. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
   b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
   c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.
   d. Hubbell Incorporated; RACO Products; www.hubbell-rtb.com.
   e. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com
   f. Appleton Electric, a brand of Emerson Corporation; www.emersonindustrial.com
   g. Walker Systems, a part of Wiremold, a brand of Legrand; www.legrand.us

D. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
1. Manufacturers:
   a. Appleton, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
   b. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
   c. Hubbell Incorporated; Killark Products: www.hubbell-killark.com.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces are ready to receive boxes.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and the Local authority Electrical Code.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
1. In masonry walls, saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 - Access Doors and Panels as required where approved by the Architect/Engineer of Record.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26 - Wiring Devices.
   b. Communications Systems Outlets: Comply with Section 27 10 00 - Structured Cabling.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Unless otherwise indicated, where multiple outlet boxes are installed at the same location and at the same mounting height, install devices in multi-gang barriered box appropriate for the devices types.
   a. Multi-ganged devices shall have a common, multi-device faceplate.
8. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
9. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
10. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect/Engineer of Record:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.
12. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
13. Installation of Combination Device Wall Enclosures:
    a. In each instance where two or more device boxes are generally located in the same vicinity and at the same mounting height, mount those devices in a common multi-gang barriered box appropriate for the device types.
    b. Combination receptacle and communications devices (i.e. television, data and receptacle shall be installed in minimum 2 gang boxes with barriers to segregate the systems.
    c. Combination devices (i.e. data/voice outlet and normal and IG receptacle) installed in minimum 3 gang box under common wall plate. Provide barriers to segregate systems.

H. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 - Hangers and Supports for Electrical Systems using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Install hinged-cover enclosures and cabinets plumb. Support each corner.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Floor-Mounted Cabinets: Mount on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00 - Cast-in-Place Concrete.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide minimum 2-gang box with barriers for combination receptacle and data locations for specialty equipment (i.e. televisions, monitors).

S. Combination devices (i.e. data/voice outlet and normal and isolated ground receptacle) installed in minimum 3-gang box with barriers.

T. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

U. Identify boxes in accordance with Section 26 05 53 - Identification for Electrical Systems.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

C. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 33.16

SECTION 26 05 33.23

SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface raceway systems.

B. Wireways.

1.02 REFERENCE STANDARDS

A. Municipal Code of the Local authority, Building/Electrical Code Requirements; 2018.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NFPA 70 - National Electrical Code; 2017.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

F. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.

G. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 - Boxes for Electrical Systems and conduit provided under Section 26 05 33.13 - Conduit for Electrical Systems as required for installation of raceways provided under this section.
3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
4. Wall Duct: Coordinate the work with other trades to provide walls suitable for installation of flush-mounted wall duct where indicated.
5. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install raceways until final surface finishes and painting are complete.
2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
   1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

C. Shop Drawings:
   1. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with the Local authority Electrical Code.

B. Product Listing Organization Qualifications: An organization recognized by OSHA Regulation 1910.7 as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by the Local authority Electrical Code and product listing.

2.02 SURFACE RACEWAY SYSTEMS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Wiremold, a brand of Legrand North America, Inc.: www.legrand.us.

B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
   1. Galvanized steel with snap-on cover.
   2. Manufacturer's standard enamel finish in color selected by the Architect/Engineer of Record.

C. Multi-outlet Assemblies: Listed and labeled as complying with UL 111.

2.03 WIREWAYS

A. Manufacturers:
   1. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.

2. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
3. Schneider Electric; Square D Products: www.schneider-electric.us.

B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

C. Wireway Type, Unless Otherwise Indicated:
1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.
2. Outdoor Locations: NEMA 250, Type 3R, painted steel with screw-cover; include provision for padlocking.
3. Hazardous Locations: NEMA 250, Type 12, painted steal with screw-cover. Sealed and gasketed.

D. Finish for Painted Steel Wireways: Manufacturer's standard enamel finish unless otherwise indicated.

E. Where wireway size is not indicated, size to comply with the Local authority Electrical Code but not less than applicable minimum size requirements specified.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with the Local authority Electrical Code to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Arrange wireways and associated raceway connections to comply with the Local authority Electrical Code, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

E. Secure and support raceways in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems at intervals complying with the Local authority Electrical Code.

F. Close unused raceway openings.

G. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

H. Identify raceways in accordance with Section 26 05 53 - Identification for Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect raceways for damage and defects.

C. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION 26 05 33.23

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Identification signs.
D. Wire and cable markers.
E. Voltage markers.
F. Floor marking tape.
G. Warning signs and labels.

1.02 REFERENCE STANDARDS

A. 29 CFR 1910.145 - Accident Prevention Signs and Tags current edition.
B. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.
C. Local authority Electrical Code - Municipal Code of the Local authority, Building/Electrical Code Requirements 2018.
D. NFPA 70E - Standard for Electrical Safety in the Workplace 2018.
E. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
    1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
B. Sequencing:
    1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
    2. Do not install identification products until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
C. Samples:
    1. For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features..
D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with ASME A13.1.
B. Comply with ANSI/IEEE 802.7.
C. Comply with 29 CFR 1910.145.

1.06 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

1.07 COORDINATION

A. Coordinate all names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Designations and labeling shall be consistent throughout the project.

B. Coordinate installation with coverings and painting of surfaces.
C. Coordinate installation with location of access panels and doors.
D. Install identifying devices before installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
a. Panelboards:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
b. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.
2. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with the Local authority Electrical Code.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with the Local authority Electrical Code.
5. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with the Local authority Electrical Code.
6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
7. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
8. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
9. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
10. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances.
a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 - Interior Painting and 09 91 13 - Exterior Painting.
11. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring

documentation by the Local authority Electrical Code, including but not limited to the following..

a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

12. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
    a. Comply with NFPA 70E
    b. Minimum Size: 3.5 by 5 inches.
    c. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
    d. Labels shall be machine printed, with no field-applied markings.
    e. Service Equipment: Include the following information in accordance with the Local authority Electrical Code.
        1) Nominal system voltage.
        2) Available fault current.
        3) Clearing time of service overcurrent protective device(s).
        4) Date label applied.
13. Within all switchboard rooms, electrical closets, and other spaces containing electrical equipment provide the following:
    a. Vitreous enameled metal sign, red on white, reading "Electrical Equipment Room - No Storage Permitted."
    b. Mounted in clearly visible locations within rooms.
        1) If wall space in room does not permit mounting, mount to door on inside of room.
14. In all switchboard rooms:
    a. Install up-to-date black-lined print of feeder diagram of building completed with feeder schedules.
        1) Print shall be installed in frame, behind glass.
        2) Print to include up-to-date field record information.
        3) Print to be on mylar.
        4) Print to have lettering no smaller than 1/8 inch.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes where there are more than three branch circuits, provide metal tags. Provide source and circuit number for each ungrounded conductor..

c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
d. Provide write-on tags to conductors and list source and circuit number for conductors to be extended in the future.

4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
5. Use underground warning tape to identify direct buried cables and cables buried in raceway for the following systems:
   a. Power
   b. Lighting
   c. Communications
   d. Control wiring
   e. Optical Fiber
   f. Connection to City OEMC network

C. Identification for Raceways:
1. Comply with ASME A13.1 for size of letters for legend and minimum length of color field for each raceway.
2. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
3. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Color Code:
         (a) Emergency Power System: Red.
         (b) Fire Alarm System: Red.
         (c) Control Wiring: Green and red.
         (d) Telecommunication Systems:
            (1) Provide blue colored conduit for telecommunication system raceway. Conduit to be in accordance with Section 26 05 33.13 - Conduit for Electrical Systems.
         (e) Mechanical and Electrical Supervisory System: Green and blue.
         (f) Security System: Blue and yellow.
         (g) Fire-Suppression Supervisory and Control System: Red and yellow.
      2) Field-Painting: Comply with Section 09 91 23 - Interior Painting and 09 91 13 - Exterior Painting.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
   a. Provide one label or marker at each end of the pathway and at any exposed pints (i.e., screw cover boxes, pull points, etc.)
5. Exposed raceways shall be labeled at transitions into and out of inaccessible spaces.
6. Provide alphanumeric identifiers to designate locations for origin and the end of the pathway.
   a. Type of pathways shall be identified:
      1) CN-conduit
      2) TCN-telecommunications conduit
      3) RK-rack
      4) W-workstation

b. Numbered from each origin point in series starting from 1.

7. Use underground warning tape to identify underground raceways.
8. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 23 - Interior Painting and 09 91 13 - Exterior Painting per the same color code used for raceways.
b. For exposed boxes in public areas, do not color code.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
a. For exposed boxes in public areas, use only identification labels.

E. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26 - Wiring Devices.
2. Use identification label to identify fire alarm system devices.
a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
3. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
a. Seton Identification Products: www.seton.com/#sle.
b. Quentin D. Schwab.
c. Joe Halm Building Specialties
d. Mechanical Tag Systems
e. N&E Specialty Company
2. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic nameplates suitable for exterior use.
1) With non-corroding screws.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or melamine with beveled edges; minimum thickness of 1/16 inch; engraved text.
4. Text:
a. Text to be 1/2 inch high letters on 1-1/2 inch label for single line.
b. Text to be 1/2 inch high letters on 2 inch label for 2 line text applications.
c. Increase sizes of labels and letters to be viewed from floor in elevated applications.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1.5 inches by 2.5 inches.

2. Legend:
    a. System designation where applicable:
    b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
    a. System Designation: 1/2 inch.
    b. Equipment Designation: 1/2 inch.
5. Color:
    a. Normal Power System: White text on black background.
    b. Emergency Power System: White text on red background.
    c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.03 IDENTIFICATION SIGNS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches; 1/2 inch for viewing distances up to 72 inches; and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions. Provide additional information as required.

2.04 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, vinyl split sleeve, or metal tag type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags or metal tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Text Height: Comply with ANSI A13.1.

F. Color: Black text on orange background unless otherwise indicated.

2.05 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
   a. Emergency Power System: Text "EMERGENCY".
   b. Other Systems: Type of service.

E. Color: Black text on orange background unless otherwise indicated.

2.06 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with over laminate, 3 inches wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Comply with Local authority Electrical Code and 29 CFR 1910.145.

B. Warning Signs:

1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

D. Shall include, but not limited to, the following legends:

1. Multiple power source warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace clearance warning: " WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.
C. Install identification products centered, level, and parallel with lines of item being identified.
D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
G. Secure rigid signs using stainless steel screws.
H. Mark all handwritten text, where permitted, to be neat and legible.
I. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   1. Power transfer switches.
   2. Controls with external control power connections.

3.03 PATHWAY IDENTIFICATION

A. Conduit labels shall be made adhesive and a minimum of ¾ inch wide, embossed with the designations in 5/16-inch high letters (numbers placed in 2 locations for all spaces and on all pathways at both ends) and legibly written with a permanent marker.
B. Minimum of two (2) labels, one at each end of the pathway and any exposed points (i.e., screw cover boxes, pull points, etc.).
C. Exposed raceways do not need to be labeled unless transitioning into or out of an inaccessible space. When necessary, raceway designation will be (RW).
D. All pathways shall be identified with an alphanumeric identifier to designate locations for the origin and the end of the pathway.
E. Pathways shall follow the hierarchy.
F. Final identification shall be required at the beginning and the end of the pathway and at all accessible points along the pathway (i.e. Pull boxes)
   1. Example: Conduit leaving MDF and ending at classroom concentrator 232:

ROOM PRIMARY SIGNIFICANCE **MDF**	**MDF-CCE232** ROOM OF SECONDARY SIGNIFICANCE

MAIN DISTRIBUTION FRAM	**CCE232** CLASSROOM CONCENTRATOR ENCLOSURE ROOM 232

2. Example: Telecommunications service entrance from the main service entrance to the MDF:

ROOM PRIMARY SIGNIFICANCE **MDF** MAIN DISTRIBUTION FRAME	**MDF-TCN** CONDUIT IDENTIFICATION **TCN** TELECOMMUNICATIONS SERVICE ENTRANCE

3. When multiple rooms of secondary significance are combined together (Branched off) within the same common conduit, leaving the room of significance, each label will be attached to the common conduit and Identified on a spreadsheet in the enclosure pockets and the MDF binder.
   a. Example:
      1) **MDF-SCE256**
      2) **MDF-TCE254**
4. When multiple conduits are extended from the MDF to a common location, a distinction is to be made between the conduits.
   a. Example: Two conduits from MDF to the Telecommunications Service Entrance:

ROOM PRIMARY SIGNIFICANCE **MDF** MAIN DISTRIBUTION FRAME	MDF-TCN-CN1 (2) CONDUIT IDENTIFICATION **TCN** TELECOMMUNICATIONS SERVICE ENTRANCE	CONDUIT IDENTIFICATION **CN1** CONDUIT 1

3.04 IDENTIFICATION SIGN INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Electronic shut off valves are to be identified with signs at the activating switch or button, including:
   1. Gas Shut Off
   2. Emergency Boiler Shut Off
   3. Emergency Generator Shut Off

3.05 WARNING SIGN INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Warning Signs are required for the following elements:
C. Warning Lights are to have an accompanying sign identifying the light meaning, including:
D. “Gas Usage in Space” for Science Labs and Prep Rooms
E. “Do Not Enter – Photo Developing” for Photography Dark Rooms
F. “Refrigerant Alarm” at Chiller Room

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.
B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 05 53

SECTION 26 05 83

WIRING CONNECTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 REFERENCE STANDARDS

A. Municipal Code of the Local authority, Building/Electrical Code Requirements; 2018.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).

C. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

D. NFPA 70 - National Electrical Code; 2017.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.
3. Review with all other trades and equipment installers all connection requirements prior to initiation of work.

B. Sequencing:
1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Confirm to requirements of Local authority Electrical Code.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Disconnect Switches: As specified in Section 26 28 16.16 - Enclosed Switches and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 27 26 - Wiring Devices

D. Flexible Conduit: As specified in Section 26 05 33.13 - Conduit for Electrical Systems.

E. Wire and Cable: As specified in Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

F. Boxes: As specified in Section 26 05 33.16 - Boxes for Electrical Systems.

2.02 EQUIPMENT CONNECTIONS

A. Equipment connections are as indicated on drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION 26 05 83

SECTION 26 08 13

TESTING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements for Electrical Testing including, but not limited to:
   1. Insulation resistance test.
   2. Continuity test.
   3. Voltage test.
   4. Phase relationship verification.

B. Correction of defective components or systems.

C. Retest of corrected components, systems.

1.02 REFERENCE STANDARDS

A. Local Authority Electrical Code.

B. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

1.03 SUBMITTALS

A. Test reports: Submit six (6) copies of all test reports to Architect/Engineer of Record (3 copies), General Contractor (1) and Owner.
   1. Type each test report on 8-1/2" x 11" paper. Include:
      a. Project title and location.
      b. Test performed.
      c. Data performed
      d. Test equipment used.
      e. Contractor's name, address and telephone number.
      f. Testing firm's name, address and telephone number.
      g. Names and tittles of persons:
         1) Performing the test.
         2) Observing test
         3) Statement verifying each test.
         4) Nameplate data from each motor and equipment item tested.
         5) Test results.
         6) Retest results after correction of defective components, systems.
         7) Dates and time of test.
   2. For each copy, assemble all test reports and bind them in a folder. Label each folder, "Electrical Test Reports" and include project number, title and location.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Furnish all equipment, manpower and casual labor to perform specified testing.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that all electrical work is completed and ready for testing.

B. Disconnect all devices or equipment that may be damaged by application of test voltages, voltage or reversed phase sequence or other procedures.

3.02 TESTING:

A. Conduct tests and adjust equipment to verify compliance with specified performance.

B. Comply with NETA ATS.

3.03 INSULATION RESISTANCE TESTS

A. Resistance measured: line-to-ground.

B. Perform testing on the following items:
1. Item Tested: No. 2 and Larger Cables (600V).
    a. Minimum Acceptance Voltage of Test: 1000V.
    b. Resistance in Mega ohms: 50.

3.04 CONTINUITY TESTS:

A. Test branch circuits and control circuits to determine continuity of wiring and connection.

3.05 VOLTAGE TESTS

A. Make and record voltage tests and record at the following listed points. Conduct tests under normal load conditions.
1. Terminals of all motors.
2. Terminals of all equipment, i.e., UPS, refrigeration compressors, etc.

3.06 PHASE RELATIONSHIP

A. Examine connections to equipment for proper phase relationships. Verify proper motor rotation.

3.07 CORRECTION OF DEFECTS

A. When tests disclose any unsatisfactory workmanship or equipment furnished under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.

B. When any wiring or equipment is damaged by tests, repairs or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.

3.08 CONTRACTOR STARTUP AND REPORTING

A. Contractor shall prepare and submit a complete set of test reports as outlined in this section.

END OF SECTION 26 08 13

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Occupancy/Vacancy sensors.
B. Daylighting controls.
C. Low Voltage Wall Control Devices.
D. Lighting contactors.
E. Toggle Switches

1.02 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2010.
B. Local authority Electrical Code - Municipal Code of the Local authority, Building/Electrical Code Requirements 2018.
C. Local authority Energy Conservation Code - Municipal Code of the Local authority, Title 14N, Based on the International Energy Conservation Code with Amendments Current.
D. Local authority Building Code - Municipal Code of Local authority, Title 14B, Building Code 2019.
E. IEEE C62.41.1 - IEEE Standard Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits 2002 (Reaffirmed 2008).
F. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
G. IEEE C62.45 - Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits 2002.
H. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
I. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
J. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
K. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
L. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
M. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting Current Edition, Including All Revisions.
N. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control Current Edition, Including All Revisions.
O. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.
P. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
    1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
    2. Coordinate the placement of wall switch occupancy/vacancy sensors with actual installed door swings.
    3. Coordinate the placement of occupancy/vacancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.

4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect/Engineer of Record of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Pre-Wire Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
1. Low voltage wiring requirements.
2. Separation of power and low voltage/data wiring.
3. Wire labeling.
4. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
5. Control locations.
6. Load circuit wiring.
7. Connections to other equipment.
8. Installer responsibilities.

C. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. See Section 01 33 29 - LEED Sustainable Design Reporting, when required.
C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
D. Shop Drawings:
1. Occupancy/Vacancy Sensors: Provide lighting plan indicating location, device coverage, model number, and orientation of each occupancy/vacancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
3. Interconnection diagrams for occupancy sensors and daylighting controls showing field-installed wiring.
E. Field Quality Control Reports.
F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
G. Operation and Maintenance Data: Include detailed information on device programming and setup.
H. Maintenance Materials: Furnish the following use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Manufacturer's recommended operation and maintenance practices for each type of product including, but not limited to:
a. Tools required.
b. Acceptable cleaners and recommended cleaning practices.
c. Replacement parts list.
d. Manufacturer service department contact information.

e. Submittal data.
f. Intended operation narrative.

I. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.05 QUALITY ASSURANCE

A. Listed and labeled as defined in the Local authority Electrical Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with Local authority Building Code, Local authority Energy Conservation Code and Local authority Electrical Code.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.
B. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide five year manufacturer warranty for all occupancy/vacancy sensors.
C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
D. Provide two year manufacturer warranty for all daylighting controls.
E. Except as otherwise noted, products provided shall be warranted against defects in design, manufacture, and operation for a period of not less than five (5) years.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Occupancy/Vacancy sensors: 1% of total devices; minimum of 2 devices
2. Outdoor motion sensors: Minimum one of each type.
3. Outdoor photoelectric controls: Minimum one of each type.
4. Daylighting controls: Minimum one of each type.
5. Powerpacks: Minimum one of each type.
6. Low Voltage Wall Control Devices: Minimum two of each type.
7. Lighting contactors: Minimum one of each type.
8. Toggle Switches: Minimum two of each type.
9. Line Voltage Dimmer Switches: Minimum two of each type.
10. Switch Button Covers: equal to five percent of amount installed for each size/type indicated, but no fewer than five for each size/type.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.
B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 INDOOR OCCUPANCY/VACANCY SENSORS

A. Manufacturers:
1. Cooper Lighting Solutions, Inc: https://www.cooperlighting.com/
2. Hubbell Building Automation: www.hubbellautomation.com.
3. Lutron Electronics Company, Inc: www.lutron.com/sle.
4. WattStopper: www.wattstopper.com/#sle.

B. All Occupancy/Vacancy Sensors:
1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such

as small desktop level movements, according to published coverage areas, for automatic control of load indicated.

2. Sensor Technology:
   a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
5. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
6. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   a. Coordinate both technologies within the same sensor to have the same coverage area.
7. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
8. Turn-Off Delay: Field adjustable, with time delay setting over a minimum range of 1 to 15 minutes.
9. Sensitivity: Field adjustable.
10. Compatibility (Non-Dimming Sensors): Suitable for controlling low-voltage lighting with electronic transformers, and fractional motor loads, with no minimum load requirements.
11. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings. Provide any power packs, relay and control components necessary for a fully functional complete system.
12. Where multiple occupancy sensors occur within the same space, connect sensors together to control the lights as a unit.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
14. Bypass Switch: Override the on function in case of sensor failure.

C. Wall Switch Occupancy/Vacancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
      c. Where indicated, provide two button units for raise/lower dimming of a single lighting load.
      d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      e. Finish: Match finishes specified for wiring devices, unless otherwise indicated.
      f. Provide vandal resistant coated-steel wire cage for passive infrared (PIR) and dual technology wall switch occupancy sensors located in areas subject to damage or vandalism.

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Provide field selectable setting for disabling LED motion detector visual indicator.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Locate sensors away from areas with strong air currents such as adjacent to HVAC diffusers.
      f. Layout of sensors shall account for sensitivity adjustments below maximum and any absorptive materials such as carpeting or material covered partitions.
      g. Finish: White unless otherwise indicated.

   2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 600 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      b. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

E. Power Packs for Low Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
   2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating: As required to control the load indicated on drawings.

2.03 DAYLIGHTING CONTROLS

A. Manufacturers:
   1. Acuity Brands Lighting, Inc: https://www.acuitybrands.com/
   2. Cooper Lighting Solutions, Inc: https://www.cooperlighting.com/
   3. ETC Company; https://www.etcconnect.com/
   4. Hubbell Building Automation, Inc: www.hubbellautomation.com
   5. Leviton Mfg. Company, Inc: www.lutron.com
   6. Lutron Electronics Company, Inc: www.lutron.com/sle.
   7. WattStopper: www.wattstopper.com.

B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors, manual override controls, and lighting control system.

C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
   1. Sensor Type: Filtered silicon photo diode.
   2. Sensor Range:
      a. Indoor Photo Sensors: 10 to 200 footcandles.
      b. Atrium Photo Sensors: 100 to 1000 footcandles.
      c. Corridor Photo Sensors: 100 to 1000 footcandles.

d. Skylight Photo Sensors: 1000 to 10,000 footcandles.
1) Housed in threaded plastic fitting for mounting under skylight, facing up at skylight.

3. Finish: White unless otherwise indicated.
4. Relay Unit: Power supply to sensor shall be 24V dc, 150 mA and Class 2 power source as defined by the Local authority Electrical Code.
5. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
6. Indicator: Two LEDs to indicate the beginning of on-off cycles.
7. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773AUL . Sensor shall be powered from the relay unit

2.04 LOW VOLTAGE WALL CONTROL DEVICES

A. Switch Control/Manual Override Stations: Control voltage, momentary contact, push button style switching devices providing the indicated switch function to interface with the modular/networked control system. Provided with the following:
1. 1,2,3,4, or 8 pushbutton actuators on a single gang device.
2. Removable buttons for field replacement
3. LED on the face of each pushbutton providing visual feedback of switch/load status and switch/programming assignment.
4. Thermoplastic construction designed for ganged wall box installation with other similar devices.
5. Modular wiring terminations for the connection of field wiring between modular/networked control devices.

B. Scene Control Stations: Control voltage, solid state, devices providing dimming function(s) and ON/OFF function(s) from the same device and interfaces with the modular/networked control system. Provided with the following:
1. Pushbutton pre-set control of multiple loads as well as the ability to manually raise/lower the lighting levels of each of the pre-set loads.
2. Individual pre-set scene buttons and separate raise/lower control function shall be programmed and provided on a sign gang strap device.
3. Thermoplastic construction designed for ganged wall box installation with other similar devices.
4. Modular wiring terminations for the connection of field wiring between modular/networked control devices.

C. Dimming Control Stations: Control voltage, solid state, devices providing dimming function to interface with the modular/networked control system. Provided with the following:
1. Single button style actuator to manually raise/lower and turn ON/OFF controlled luminaire(s) lighting level.
2. Multi-location (3-way and 4-way) control function of connected loads.
3. LED indicators provide visual feedback for programming and troubleshooting.
4. Thermoplastic construction designed for ganged wall box installation with other similar devices.
5. Modular wiring terminations for the connection of field wiring between modular/networked control devices.

2.05 LIGHTING CONTACTORS

A. Manufacturers:
1. ABB/GE: www.geindustrial.com/#sle.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co
3. Eaton Corporation: www.eaton.com/#sle.

4. Rockwell Automation Inc; Allen-Bradley Products: ab.rockwellautomation.com/#sle.
5. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B. Description: Electrically operated and mechanically held lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

C. Short Circuit Current Rating:
1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Enclosures:
1. Comply with NEMA ICS 6.
2. Environment Type per NEMA 250: As indicated on the drawings.
3. Finish: Manufacturer's standard unless otherwise indicated.

2.06 TOGGLE SWITCHES

A. Manufacturers subject to compliance with requirements, provide products by one of the following manufacturers:
1. Cooper Lighting Solutions, Inc: https://www.cooperlighting.com/
2. Hubbell Incorporated: www.hubbell-wiring.com.
3. Leviton Manufacturing Company, Inc: www.leviton.com.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Lighted Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Pilot Light Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

F. Locking Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

G. Momentary Contact Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

H. Locking momentary contact wall switches: Heavy duty specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.

2.07 LINE VOLTAGE DIMMERS

A. Manufacturers subject to compliance with requirements, provide products by one of the following manufacturers:
1. Acuity Brands Lighting, Inc: https://www.acuitybrands.com/
2. Cooper Lighting Solutions, Inc: https://www.cooperlighting.com/

3. Hubbell Incorporated: www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc: www.leviton.com.
   1. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.
   3. WattStopper: www.wattstopper.com.

C. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

D. Control: Continuously adjustable slide control type with separate on/off switch..

E. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
   1. Incandescent: 600 W.
   2. Magnetic Low-Voltage: 600 VA.
   3. Electronic Low-Voltage: 600 VA.
   4. Fluorescent: 600 VA.
   5. LED: 300 VA

F. Provide locator light, illuminated with load off.

G. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

H. 600W dimmers shall require no derating when ganged with other devices.

I. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with Local authority Electrical Code.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

C. Protect installation from dust and debris of other construction activities.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 - Boxes for Electrical Systems as required for installation of lighting control devices provided under this section.
   1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect/Engineer of Record to obtain direction prior to proceeding with work.

C. Install and aim sensors in locations to achieve not less than 95 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
D. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceiling or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.
E. Install lighting control devices in accordance with manufacturer's instructions.
F. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
G. Install lighting control devices plumb and level, and held securely in place.
H. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26 - Wiring Devices - Lutron.
I. Provide required supports in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.
J. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
K. Identify components and power and control wiring according to Section 26 05 53 - Identification for Electrical Systems.
    1. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
    2. Label time switches with a unique designation.
L. Occupancy/Vacancy Sensor Locations:
    1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect/Engineer of Record.
M. Daylighting Control Photo Sensor Locations:
    1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect/Engineer of Record.
    2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
    3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
N. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
O. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
P. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
Q. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 05 33.16 - Boxes for Electrical Systems for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.
B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
D. Test time switches to verify proper operation.
E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.
B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect/Engineer of Record.
C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
D. Where indicated or as directed by Architect/Engineer of Record, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect/Engineer of Record. Record settings in written report to be included with submittals.
F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect/Engineer of Record.
G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect/Engineer of Record. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect/Engineer of Record.
H. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.
B. After system checkout and adjustment, the contractor shall operate the system for the review of the Architect/Engineer of Record. Necessary adjustments or modifications shall be made as required by the Architect/Engineer of Record.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
C. Demonstration: Demonstrate proper operation of lighting control devices to Architect/Engineer of Record, and correct deficiencies or make adjustments as directed.
D. Training: Train personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two (2) sessions of four (4) hours of training. Provide a recording of one of the sessions for future use.
3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
4. Location: At project site.

END OF SECTION 26 09 23

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Revision E with Supplement 1, 2013.

B. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).

E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

F. NEMA PB 1 - Panelboards; 2011.

G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

I. NFPA 70E - Standard for Electrical Safety in the Workplace; 2017.

J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

L. UL 67 - Panelboards; Current Edition, Including All Revisions.

M. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

O. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

P. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

Q. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

R. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by the Local authority Electrical Code.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate short circuit current ratings.
   4. Include documentation of listed series ratings.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
   1. Panelboard Schedules: For installation in panelboards. Submit final typewritten versions after load balancing.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

I. Maintenance Materials: Furnish the following for Board's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Six (6) spares of each different key.
   3. See Section 26 28 13 - Fuses for requirements for spare fuses and spare fuse cabinets.

1.05 QUALITY ASSURANCE

A. Conform to the Local authority Electrical Code.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through on source from a single manufacturer.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three (3) years documented experience.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Local authority Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with NEMA PB 1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

B. Altitude: Not exceeding 6600 feet.

C. Interruption of Existing Electrical Service: Do not interrupt electric service to facilities occupied by Board or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect/Engineer of Record and Board's Representative not fewer than seven (7) working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect/Engineer of Record's and Board's Representative written permission.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc: www.usa.siemens.com.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Short Circuit Current Rating, Fully Rated:
1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73 - Power System Studies.
2. Listed series ratings are acceptable, except where not permitted by motor contribution according to the Local authority Electrical Code..
3. Label equipment utilizing series ratings as required by the Local authority Electrical Code.

C. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
5. Split Bus: Vertical buses divided into individual verticals.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
   c. Kitchen Areas: NEMA 250, Type 4x, stainless steel.

d. Other Wet of Damp Indoor Locations: NEMA 250, Type 4.

2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.
5. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
6. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
7. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panels.
8. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

I. Comply with NFPA 70E for arc flash labels.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00 - Surge Protective Devices, list and label panelboards as a complete assembly including surge protective device.

L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2, Class 2.
   1. Ampere Rating: Not less than ampere rating of panelboard bus.
   2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
   3. Coil Voltage: As required for connection to control system indicated.
   4. Combination controller equipped for panelboard mounting and including the following accessories:
      a. Individual control-power transformers.
      b. Fuses for control-power transformers.
      c. Indicating lights.
      d. Seal-in contact.
      e. Two convertible auxiliary contacts.
      f. Push buttons.
      g. Selector switches.
      h. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
      i. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.

b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

O. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

P. Circuit Monitors for panelboard Circuit Breakers
1. Provide space and voltage taps in each panel with electrical submetering equipment.
a. Voltage taps will be designed for 14 to 12 gage wire.
b. To determine space requirements use Veris H8053 with 3 current transformers.
c. The submeter maybe field or factory installed. The Division 24 BAS system installer will provide submeter.
d. If indicated on the drawings, two sets of submeters will be provided. For example, if a panel to be monitored includes both lighting and plug loads.

Q. Phase and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors and insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual verticals.
6. Integral TVSS or provision for the connection of the remote TVSS.

R. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Compression.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

F. Emergency and Exit Lighting Branch Circuit Panelboards: Provide overcurrent protective devices Type S pug fuses within panelboards in compliance with applicable codes.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Copper, suitable for terminating copper conductors only.

B. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. For Circuit-Breaker Frame Sizes 125A and Smaller: Bolt-on circuit breakers.
3. For Circuit-Breaker Frame Sizes Larger Than 125A: Bolt-on circuit breaker; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
4. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
5. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Provide compression lugs where indicated.
   c. Lug Material: Copper, suitable for terminating copper conductors only. Mechanical style, suitable for number, size, trip ratings, and conductor materials.
6. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 250 amperes and larger.
   b. Provide interchangeable trip units where indicated.
7. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

2) Long time delay.
3) Short time pickup and delay.
4) Instantaneous pickup.
5) Ground fault pickup and delay where ground fault protection is indicated.

b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
c. Provide communication capability where indicated: Compatible with system indicated.

8. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
9. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
10. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting; Type HACR for heating, air-conditioning, and refrigerating equipment.
11. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
12. Do not use tandem circuit breakers.
13. Do not use handle ties in lieu of multi-pole circuit breakers.
14. Provide multi-pole circuit breakers for multi-wire branch circuits as required by the Local authority Electrical Code.
15. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage where indicated on drawings.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
   c. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
   d. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
   e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
   f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   g. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
   h. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
16. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front mounted, field-adjustable trip setting.

2.05 CIRCUIT MONITORS - FOR PANELBOARD CIRCUIT BREAKERS

A. Provide space and voltage taps in each panel with electrical submetering equipment.
   1. Voltage taps will be designated for 14 to 12 gage wire.
   2. To determine space requirements use Veris H8053 with three (3) current transformers.
   3. The submeter maybe field or factory installed. the Division 23 BAS system installer will provide submeter.
   4. If indicated on the Drawings, two (2) sets of submeters will be provided. For example, if a panel to be monitored includes both lighting and plug loads.

2.06 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and the Local authority Electrical Code.

D. Provide required supports in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the top of trim is 74 inches above the finished floor, unless otherwise indicated.

H. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00 - Cast-in-Place Concrete.

I. Provide minimum of four spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
   2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

K. Install all field-installed branch devices, components, and accessories.

L. Provide fuses complying with Section 26 28 13 - Fuses for fusible switches as indicated.

M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by the Local authority Electrical Code.

O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73 - Power System Studies.

P. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also, provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

S. Identify panelboards in accordance with Section 26 05 53 - Identification for Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 250 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by the Local authority Electrical Code.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 COMMISSIONING AND DEMONSTRATION

A. Training: Arrange and pay for the services of factory-authorized service representatives to demonstrate Panelboards and OCPD’s and train Board’s maintenance personnel.

B. Conduct a minimum of one half (1/2) day of training in operation and maintenance as specified in Division 01 Section “Closeout Procedures”. Include both classroom training and hands on equipment operation and maintenance procedures.

C. Schedule training with at least seven (7) days’ advance notice.

D. Balancing Loads: After Preliminary Acceptance, but not more than two (2) months after Final Acceptance, conduct load-balancing measurements and make circuit changes as follows:
   1. Perform measurements during period of normal working load as advised by Board.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility. Make special arrangements with Board to avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
   3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
   4. Tolerance: Difference exceeding twenty (20) percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

E. Contractor Start-Up and Reporting. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

F. Contractor Start-Up and Reporting. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.
B. Fan speed controllers.
C. Receptacles.
   1. Tamper Resistant Devices
   2. GFCI Devices
   3. Isolated Ground Devices
   4. USB Charging Devices

1.02 REFERENCE STANDARDS

A. Local authority Building Code - Municipal Code of Local authority, Title 14B, Building Code 2019.
B. FS W-C-596 - Connector, Electrical, Power, General Specification for 2017h.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
F. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).
G. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
H. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
J. UL 355 - UL Standard for Safety Cord Reels 2004 (amendments through October 7, 2020).
K. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
L. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
M. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
N. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.
O. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.
P. UL 1917 - Solid-State Fan Speed Controls Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
   6. Notify Architect/Engineer of Record of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. See Section 01 33 29 - LEED Sustainable Design Reporting, when required.

C. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.
   2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

D. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

E. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449, 3rd Edition.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Operation and Maintenance Data:
   1. GFCI Receptacles: Include information on status indicators.
   2. Surge Protection Receptacles: Include information on status indicators.
   3. Acceptable cleaners and recommended cleaning practices for all wiring devices.
   4. Replacement parts list for all wiring devices.
   5. Manufacturer's service department contact information.

I. Project Record Documents: Record actual installed locations of wiring devices.

J. Maintenance Materials: Furnish the following use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Screwdrivers for Tamper-Resistant Screws: Two (2) for each type of screw.
   3. Extra Wall Plates: One (1) of each style, size, and finish.

1.05 QUALITY ASSURANCE

A. Conform to NFPA 101.

B. Comply with the Local authority Electrical Code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

E. Products: Listed and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

G. Source Limitations: Obtain all wiring devices and associated wall plates from a single manufacturer and one source if available. Obtain each type of wiring device and associated wall plate through one source from a single manufacturer if not all wiring devices are available from a single source.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
E. Provide GFCI protection for receptacles installed in kitchens.
F. Provide GFCI protection for receptacles serving electric drinking fountains.
G. Provide GFCI protection for receptacles serving vending machines.
H. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers and as requested by AV consultants.
I. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.
    1. Wiring Devices, Unless Otherwise Indicated: Ivory with satin-finished stainless steel wall plate.
    2. Wiring Devices Installed in Finished Spaces: Ivory with satin-finished stainless steel wall plate.
    3. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
    4. Wiring Devices Installed Damp Locations: White with cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet location".
    5. Isolated Ground Convenience Receptacles: Orange.

2.03 WALL SWITCHES

A. Manufacturers subject to compliance with requirements, provide products by one of the following manufacturers:
    1. Cooper Wiring Devices, a division of Cooper Industries, Inc.; http://www.cooperindustries.com
    2. Hubbell Incorporated: www.hubbell.com/#sle.
    3. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
    4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
    1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
C. Standard Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
D. Lighted Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 RECEPTACLES

A. Manufacturers subject to compliance with requirements, provide products by one of the following manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc: {HL#1115380}.
   3. Pass & Seymour, a brand of Legrand North America, Inc: {HL#1115365}.
   4. Cooper Wiring Devices, a division of Cooper Industries, Inc.; http://www.cooperindustries.com.
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Heavy duty specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Automatically Controlled Convenience Receptacles: Heavy duty specification grade 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per the Local authority Electrical Code; single or duplex as indicated on the drawings. Permanent power control signage affixed to face plate.
   3. Isolated Ground Convenience Receptacles: Heavy duty specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
      a. Isolation shall be integral to receptacle construction and not dependent on removable parts.
   4. Tamper Resistant Convenience Receptacles: Heavy duty specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
   5. Tamper Resistant and Weather Resistant Convenience Receptacles: Heavy duty specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, non-feed-through type with light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFCI Receptacles: Heavy duty specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Heavy duty specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
   4. Tamper Resistant GFCI Receptacles: Heavy duty specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

E. Tamper Resistant and Weather Resistant GFCI Receptacles: Heavy duty specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

F. USB Charging Devices:

1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
    a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
    b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
3. USB Charging Noncombination Devices: Four-port (Type A); rectangular decorator style.

2.05 WALL PLATES

A. Manufacturers:

1. Cooper Wiring Devices, a division of Cooper Industries, Inc.; http://www.cooperindustries.com
2. Hubbell Incorporated: www.hubbell-wiring.com.
3. Leviton Manufacturing Company, Inc: www.leviton.com.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer.

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.
4. Provide screwless wall plates with concealed mounting hardware where indicated.

C. Finish Spaces shall use Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with the Local authority Electrical Code.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 - Boxes for Electrical Systems as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Fan Speed Controllers: 48 inches above finished floor.
      c. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect/Engineer of Record to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Conductors:
   1. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
   2. The length of free conductors at outlets for devices shall meet provision of the Local authority Electrical Code, without pigtails.
   3. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
   4. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   5. Strip insulation evenly around conductors using tool designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   6. Pigtailing existing conductors is permitted provided the outlet box is large enough.
   7. Damaged existing conductors shall be removed and replaced.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

J. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

K. Install wiring devices plumb and level with mounting yoke held rigidly in place.

L. Install wall switches with OFF position down.
M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
P. Install ceiling mounted industrial cord reel assemblies utilizing standard mounting detail. The reel shall be installed in the fire treated ½"plywood box FDR painted, flash with the ceiling soffit above the ceiling. Attach hangers to angled brackets bolted to the concrete deck. Power junction box shall be integrated into housing.
Q. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings. Isolated Ground Receptacles: Connect to isolated grounding conductor routed to designated isolated equipment ground terminal of electrical system.
R. Identify wiring devices in accordance with Section 26 05 53 - Identification for Electrical Systems.
    1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
    2. Switches: Where three or more switches are ganged, and elsewhere where indicated, identify each switch with approved legend engraved with black-filled lettering on face of wall plate.
S. Do not used oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
T. Comply with Section 26 05 53 - Identification for Electrical Systems for labeling of wiring devices.
    1. Receptacles: Identify panelboard and circuit number from which served. Use hot stamped or engraved machine printing with black-filled lettering on face plate, and durable wire markers or tags inside of outlet boxes.
    2. Switches: Where 3 or more switches are ganged, and elsewhere where indicated, identify each switch with approved legend engraved with black-filled lettering on face of wall plate.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.
B. Inspect each wiring device for damage and defects.
C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
D. Test each receptacle to verify operation and proper polarity.
    1. Perform tests and inspections and prepare test reports.
        a. Test Instruments: Use instruments that comply with UL 1436.
        b. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
        c. Test Wiring Devices: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 times.
    2. Tests for Convenience Receptacles:
        a. Line Voltage: Acceptable range is 105 to 132 V.

b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
c. Ground Impedance: Values of up to 2 ohms are acceptable.
d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
e. Using the test plug, verify that the device and its outlet box are securely mounted.
f. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Inspect each surge protection receptacle to verify surge protection is active.
F. Correct wiring deficiencies and replace damaged or defective wiring devices.
G. Contactor Startup and Reporting:
1. Contractor shall prepare and submit a complete set of record drawings, test reports, operation and maintenance data and certificates as outlined in this Section.
H. Commissioning and Demonstration:
1. After system checkout and adjustment, the Contractor shall operate the system for the review of the Architect/Engineer of Record. Necessary adjustments or modifications shall be made as required by the Architect/Engineer of Record.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.
B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect/Engineer of Record.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.
B. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

END OF SECTION 26 27 26

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.
B. Drivers.
C. Accessories.

1.02 REFERENCE STANDARDS

A. ANSI C78.379 - Classification of the Beam Patterns of Reflector Lamps 2015.
B. ANSI C82.1 - American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts 2004 (R2015).
C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements 2017.
D. ANSI C82.77 - Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment 2002.
E. ANSI C82.SSL1 - SSL Drivers Current.
F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.
G. ASTM D788 - Standard Classification System for Poly(Methyl Methacrylate) (PMMA) Molding and Extrusion Compounds 2016.
H. Local Electrical Code - Municipal Code of the Local authority, Building/Electrical Code Requirements 2018.
I. Local authority Building Code -
J. Local authority Electrical Code - National Electrical Code.
K. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).
L. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
M. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
N. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
O. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems 2006.
P. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.
Q. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2016.
R. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.
S. NEMA LE 5 - Procedure for Determining Luminaire Efficacy Ratings for Fluorescent Luminaires 2001.
T. NEMA LE 5A - Procedure for Determining Luminaire Efficacy Ratings for Commercial, Non-Residential Downlight Luminaires 1999.
U. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
V. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
W. UL 844 - Luminaires for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
X. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
Y. UL 1598 - Luminaires Current Edition, Including All Revisions.
Z. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

A. The interior lighting system shall include all lighting fixtures, LED modules, switches, mounting, wiring, control equipment, and accessories required for complete system, whether or not they are indicated or specified, as indicated in the Drawings and as specified.

B. The luminaire schedules in the Drawings indicate manufacturer, fixture design, appearance and performance desired.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. See Section 01 33 29 - LEED Sustainable Design Reporting, when required.

C. Provide separate submittal product data/shop drawings for each fixture type clearly indicating the fixture type designation used in the Drawings and all pertinent options and accessories. Do not group similar fixture types together on a single cut sheet. Submittals that do not indicate option data where multiple selections exist will be returned without being reviewed.

D. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

E. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

3. LED Drivers: Include information as to input watts. Indicate mounting distance limitation and standard wire sizes for remote drivers, indicate dimming type and range.
4. LED modules: per luminaire tag, including life, lumen output, correlated color temperature (CC), color rendering index (CRI) and energy-efficiency data.

5. Remote Drivers: Indicate mounting distance limitation and standard wire sizes for remote drivers/transformers.
6. Efficiency Data: Provide both lumen performance efficiency and luminaire efficiency rating (LER).
7. Special Warranty: Provide documentation of compliance with special warranties as part of the product data.

F. Certification of Compatibility: Submit a written statement, signed by the Contractor, Installer, and Controls Manufacturers, certifying the power supplies and drivers, automatic lighting control devices, including occupancy sensors and daylight harvesting controls, and related components being supplied for the Project are compatible equipment. Statement shall

include that system components do not compromise the proper operation, or the design criterion, of the supplied power supplies, drivers, and automatic control devices.

G. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
   1. Include DOE "Lighting Facts" Information
   2. Include DLC listing status.
   3. Include Efficacy information.

H. Field quality control reports (by contractor).

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Operation and Maintenance Manuals: Provide a collection of manufacturer recommended maintenance practices for each lighting fixture type. Including the following:
   1. Tools required.
   2. Acceptable cleaners and recommended cleaning practices.
   3. Replacement parts list.
   4. Dates of installation.
   5. Replacement parts order information.
   6. LED module and driver re-ordering information and replacement schedule.
   7. Contact information for manufacturer's service department or qualified service agencies.
   8. Submittal data.
   9. Operation data.
   10. Intended operation narrative.
   11. Disposal information.

K. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components within thirty (30) days of date of Preliminary Acceptance.

L. Re-Commissioning Data: Submit manual containing all information required for re-commissioning of the installations.
   1. Submit two (2) copies of manual within thirty (30) days of date of Preliminary Acceptance.
   2. Submit re-commissioning manuals in heavy-duty, 3-ring binders. Submit manuals in accordance with Section 01 78 00 - Closeout Submittals.

1.05 QUALITY ASSURANCE

A. Comply with Local authority Building Code.

B. Comply with EPA, State of Illinois, and Local authority regulations for proper recycling or disposal of existing lamps and ballasts removed from the Site.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the ANSI/IEEE 802.7 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Commissioning: When required for the Project, Contractor shall assign representative(s) with expertise and authority to act on its behalf. The representative(s) shall perform commissioning activities including, but not limited to, the following:
   1. Review submittals relative to interior lighting systems being commissioned.

G. Sample Installations: Before installing lighting fixtures, install sample installations for each type of light fixture indicated or required by Architect/Engineer of Record. Sample installations shall be used to verify selections made on submittals and to demonstrate

aesthetic affects and qualities of materials and workmanship. Install sample installations to comply with the following requirements, using materials indicated for the completed work:

1. Each sample installation shall include not less than two (2) light fixtures.
    a. Where light fixtures are indicated to be installed in a continuous row, sample installation shall include all fixtures in the row.
2. Install each sample installation in the location indicated or as directed by Architect/Engineer of Record.
3. Each sample installation shall include all accessories and components necessary for a complete installation.
4. Obtain Architect/Engineer of Record's approval of sample installations before proceeding with installation of lighting fixtures.
5. Maintain sample installations during installation in an undisturbed condition as a standard for judging the completed work.
6. Approved sample installations may become part of the completed work if undisturbed at time of Preliminary Acceptance.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
C. Protect luminaires, lamps, and accessories during transit, delivery, storage, and handling to prevent damage.
D. Deliver luminaires to the Site factory-assembled and wired to the greatest extent possible and in accordance with approved submittals.
E. Store luminaires and accessories in accordance with manufacturer's instructions in a clean, dry location, protected from weather and away from dust generating construction activities. As required, cover materials with tarpaulin or polyethylene sheeting in a manner that allows air circulation and prevents condensation beneath the covering.
F. Keep handling on site to a minimum. Exercise particular care to avoid damage to exposed finishes and materials.

1.07 COORDINATION

A. Verify locations of light fixtures indicated in Drawings and coordinate with other reference data and materials as required prior to installation to ensure locations will not interfere with other work. Verify space above luminaires and confirm non-interference with other equipment, such as ducts, pipes, conduit and cabling, and openings. Alert Architect/Engineer of Record in writing to non-standard modifications required for compliance with the Contract Documents and for installation to coordinate with ceiling system before proceeding with the work.
B. Verify dimensions. Where discrepancies are found within the Contract Documents, or additional information is required, immediately contact Architect/Engineer of Record for clarifications and additional information.
C. Coordinate installation of lighting system with other trades to prevent delays in the work and to ensure the lighting fixtures and supports will not be damaged by subsequent construction operations
D. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
E. Coordinate the placement of luminaires (and luminaire suspensions systems) with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

F. Coordinate the placement of exit signs with soffits, changes in ceiling heights, furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

G. Coordinate installation of lighting fixtures indicated to extend in continuous, wall to wall installation. Provide field, or established, dimensions to luminaire manufacturer in sufficient time so not to cause delays in the work.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 EXTRA MATERIALS:

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage an identified with labels describing contents. Provide a manifest of all extra materials provided.

C. Extra Lenses and Louvers: Ten (10) percent of total quantity installed for each type, but not less than one (1) of each type.

1. Extra LED Modules: One (1) for every hundred (100) of each type and rating installed. Furnish as least two (2) of each type.

2. Extra Drivers: One (1) percent of total quantity installed for each type, but not less than one (1) of each type.
3. Battery and Charger Data: One (1) for each emergency lighting unit.
4. Globes and Guards: One (1) for every twenty (20) (5 percent) of each type and rating installed, but not less than one (1) of each type.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Special Warranty: Submit a written warranty, beginning from date of Preliminary Acceptance, and executed by the Contractor, manufacturer, and Installer agreeing to repair or replace products or components that fail in materials or workmanship within the specified warranty period. Failures shall include, but not be limited to, deterioration of metal finishes, failure of LED modules, or failure of LED drivers. Warranty shall include all materials and components, as well as labor and equipment required to remove existing and install new materials and components. The first year of warranty labor shall be provided by the contractor. The second through fifth (2-5) years of warranty labor shall be covered by the manufacturer

1. Warranty Period for LED Luminaires, including LED modules, LED boards, chips, and drivers:: Five (5) years from date of Preliminary Acceptance.

2. Warranty Period for Metal Finishes: Five (5) years from date of Preliminary Acceptance.

C. Special Warranty for Emergency Lighting Batteries: Submit a written warranty, beginning from date of Preliminary Acceptance, and executed by the Contractor, manufacturer, and Installer agreeing to repair or replace products or components that fail in materials or workmanship within the specified warranty period. Warranty shall include all materials and components, as well as labor and equipment required to remove existing and install new materials and components. The first year of warranty labor shall be provided by the

contractor. The second through fifth (2-5) years of warranty labor shall be covered by the manufacturer.

1. Warranty Period for Emergency Lighting Unit Batteries: Five (5) years from date of Preliminary Acceptance. Full warranty shall apply for first year, and prorated warranty for the remaining four (4) years.
2. Warranty Period for internal batteries of Exit and Area of Rescue Signs: Five (5) years from date of Preliminary Acceptance. Full warranty shall apply for first year, and prorated warranty for the remaining four (4) years.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Provide for proper recycling or disposal of existing lamps and ballasts removed from the site in accordance with EPA and State of Illinois regulations in accordance with Section 02 86 13 Hazardous and Universal Waste Management.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.
B. Manufacturers - Accessories: Subject to compliance with requirements, provide products by one of the manufacturers listed within the luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Product Description: Provide complete luminaire assemblies with features, options and accessories as scheduled and required for complete assembly, whether specified or not.
B. Provide fixtures constructed, wired, and installed in compliance with appropriate UL standards and applicable codes. Provide fixtures that are listed by UL for the applications and locations where they are shown. Provide all products with UL label.
   1. Provide products that are listed and labeled as complying with UL 1598, where applicable. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
C. Verify and provide luminaires that are appropriate for the mounting conditions and in accordance with the Local authority Electrical Code.
D. All fixture components must operate within the temperature limits of their design.
E. Provide products that are listed and labeled as complying with UL 1598, where applicable. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
F. Provide products listed, classified, and labeled as suitable for the purpose intended.
G. Provide products complying with Federal Energy Management Program (FEMP) requirements.
H. Unless otherwise indicated, provide complete luminaires including LED modules, LED boards, drivers, reflectors, lenses, housings and other components required to position, energize and protect the light source and distribute the light.
I. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
J. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
K. Provide specification grade products only.
L. Luminaire Coatings and Finishes:
   1. Luminaire surfaces, components, trim, and housing shall be factory pre-treated, rustproof, primed and otherwise prepared to inhibit rust and corrosion. Exposed luminaire surfaces shall be factory pre-treated, primed and finish coated with a suitable rust and corrosion inhibiting product.

2. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
    a. White Surfaces: 85 percent.
    b. Specular Surfaces: 83 percent.
    c. Diffusing Specular Surfaces: 75 percent.
    d. Laminated Silver Metallized Film: 90 percent.
3. Luminaries shall receive manufacturer's standard finish, unless otherwise indicated. Color shall be as indicated or, if not indicated, as selected by Architect/Engineer of Record from manufacturer's standard range.
4. Exposed finish shall be free of streaks, runs, holidays, stains, blisters, and similar defects.
5. Metal Parts: Free of burrs and sharp corners and edges.
6. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

M. Diffusers and Globes:
1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    a. Lens Thickness: At least 0.125 inch minimum unless otherwise is indicated.
    b. UV stabilized.
2. Glass globes, diffusers and lenses shall be fabricated from annealed crystal glass, or tempered glass, unless otherwise indicated.
3. Destaticize all panels at the factory prior to shipping.

N. Louvers:
1. Provide louvers or baffles fabricated from aluminum reflector sheet free of marks including mars and indentations caused by fabrication and assembly techniques. No rivets, springs, or other hardware shall be visible after installation. Plastic louvers are not permitted.
2. Provide non-iridescent type louvers for fixtures.
3. Provide louvers and baffles that are polished, buffed, and anodized.

O. Reflectors and Trims:
1. Attach non-permanently affixed reflectors to housing by means of safety chains or spring clips, to prevent reflectors from falling. No part of the clip or chain shall be visible after installation, when viewed from any angle up to 45 degrees from horizontal.
2. Aluminum Reflectors:
    a. Provide reflectors and reflecting cones fabricated from aluminum reflector sheet free of marks including spinning lines, mars, and indentations caused by fabrication and assembly techniques. No rivets, springs, or other hardware shall be visible after installation. Provide only reflectors free from blemishes, scratches, or indentations.
    b. Provide reflectors that are polished, buffed, and anodized.
    c. Provide non-iridescent type louvers for fixtures.
    d. Provide polished self-flanged trim cones, color finish shall match that of the cone.
3. Painted Reflectors: Completely formed before application of primer and paint. Minimum of 87 percent reflectance white.

P. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

Q. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
   4. Shall be provided with a U.S. Department of Energy (DOE) "Lighting Facts "label indicating their specific performance characteristics, tested and reported in accordance with the requirements of the most current version of IES LM-79.
   5. Chromaticity ranges for "white light" products, with various correlated color temperatures, shall be provided in accordance with ANSI/NEMA -C78.377.
   6. LEDs shall be binned within a maximum 3-step MacAdam Ellipse.
   7. Drivers and power supplies shall be provided in accordance with the requirements of ANSI/NEMA-C82.SSL1 and their maximum allowable harmonic emission limits shall be in accordance with ANSI/NEMA-C82.77.

R. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

S. Fixture Support Components: Comply with Section 26 05 29 - Hangers and Supports for Electrical Systems.
   1. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish shall be the same as the fixture.
   2. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish shall be the same as the fixture.
   3. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
   4. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord and locking-type plug.

T. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit maintenance. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.

U. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging. Free of burrs and sharp corners and edges.

2.03 DRIVERS

A. Manufacturers:
   1. Advance
   2. Cree
   3. EldoLED
   4. Enlighted
   5. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   6. Lutron Electronics Company, Inc; www.lutron.com/#sle.
   7. OSRAM Sylvania, Inc: www.osram.us/ds/#sle.
   8. Philips Lighting North America Corporation; www.usa.lighting.philips.com/#sle.
   9. Thomas Research Products
   10. Manufacturer Limitations: Where possible, for each type of luminaire provide drivers produced by a single manufacturer.
   11. Where a specific manufacturer or model of driver is indicated elsewhere, such as in the luminaire schedule or on the drawings, substitutions for that specific driver are not permitted unless explicitly indicated.

B. Drivers - General Requirements:
   1. Electronic Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
   2. Drivers and power supplies shall be provided in accordance with the requirements of ANSI C82.SSL1 and their maximum allowable harmonic emission limits shall be in accordance with ANSI C82.77.
   3. Drivers shall have internal surge protection to protect each fixture. Each fixture shall be capable of being readily disconnected from the circuit.
   4. Provide UL listed and labeled drivers. Provide drivers with temperature ratings appropriate to the installation.
   5. Fixtures intended to be dimmed shall have dimming capable drivers and be compatible with the specified dimmer controls.

C. LED Drivers - Specific Requirements:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fixtures intended to be dimmed shall have dimming driver fully compatible with the dimming controls to be installed.
   3. LED drivers shall be factory provided by the respective luminaire manufacturers, and shall be suitable for their intended use, to operate the designated LED modules listed in the Luminaire Schedule, and as specified herein, to their full light output.
   4. Comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR Part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
   5. Provide identical drivers within each luminaire type.
   6. Provide complete connection to LED type luminaires through both integrally installed and remote electronic drivers.
   7. Drivers shall be totally enclosed within a metallic enclosure, and shall be provided with integral leads color coded per ANSI Standards or with poke-in style wire retaining connectors.
   8. Surge Tolerance: Capable of withstanding characteristic surges, 10,000 aic minimum.
   9. Remote Drivers:
      a. Remote drivers are specifically not shown on the drawings. Contractor shall install remote drivers in a readily accessible, dry, indoor, concealed location, in accordance with the manufacturer's instructions.
      b. Provide ventilated metal enclosures for remote drivers furnished as loose equipment. All wiring to/from remote drivers and their associated LED luminaires shall be installed in conduit.

      c. Metal Enclosures shall be Plenum Rated
      d. Verify and comply with remote distance limitations specified by the luminaire/driver manufacturer.

2.04 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2 inch size, factory finished to match luminaire or field-painted as directed.
B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4 inch size, field-painted as directed.
C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D. Lenses:
   1. Source Limitations: Fixture lenses shall be provided by the light fixture manufacturer.
   2. Construct acrylic lenses, diffusers, covers, and globes of 100 percent virgin acrylic injection-molded plastic complying with ASTM D788. Polystyrene lenses are not acceptable.
   3. All plastic shall be highly resistant to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.
   4. Destaticize all panels at the factory prior to shipping.
   5. Lens Patterns:
      a. Pattern 12 Lens: Pattern 12 lens shall be not less than 0.125-inch thick (overall panel thickness), with inverted conical prisms, in straight flat-sided prism shape, configured on 45-degree axis layout across the entire panel.
      b. Pattern 19 Lens: Pattern 19 lens shall be not less than 0.156-inch thick (overall panel thickness), with inverted conical prisms, in straight flat-sided prism shape, configured on parallel/perpendicular 90-degree axis layout across the entire panel. Provide pattern 19 lenses in kitchens, serveries, locker rooms, and toilet rooms.

2.05 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 29 - Hangers and Supports for Electrical Systems for channel-supports.
B. Single-Stem Hangers: 1/2-inchsteel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 0.0808-inch (12 gage) minimum diameter.
D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that lighting fixture back-boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with Local authority Electrical Code.
C. Verify that suitable support frames are installed where required.
D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring lighting fixture back-boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from lighting fixture back-boxes.
C. Removal of Existing Luminaires: Disconnect and remove abandoned luminaires, including lamps and accessories, and luminaires indicated to be removed. Remove abandoned wiring in accordance with requirements of authorities having jurisdiction.
D. Removal and Reinstallation of Existing Luminaires: Carefully remove luminaires from existing locations and store as required for new luminaires. Reinstall luminaires as indicated and as specified.

1. Prior to reinstallation, luminaires shall be cleaned and repaired, including installation of new wiring, ballast(s) and lamps; replacement of broken, damaged, or faulty lamp sockets; replacement of broken or damaged lenses; replacement of faulty or nonfunctioning lamps; and damp cleaning of lens and interior of luminaires.

E. Existing Luminaires to Remain: Clean existing luminaires, lamps and accessories, indicated to remain. Make repairs to existing luminaires as required to make fully functional, including installation of new wiring, ballast(s) and lamps, and to aesthetically match newly installed luminaires of same type in same space, if any.

F. Extend existing installation using materials and methods specified.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 - Boxes for Electrical Systems as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Set level, plumb, and square with ceilings and walls. Install lamps in each luminaire.

H. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

I. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
4. Support for Luminaires in Lay-in/Accessible Ceilings: Use grid as a support element.
   a. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6-inchesfrom lighting fixture corners.
   b. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   c. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   d. Install at least two (2) independent support rods or wires from structure above to the light fixture housing. Supports shall be installed on opposite (diagonal)

corners. Wires or rods shall be capable of supporting, without failure, a load equal to three times the weight of the light fixture.

J. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Install canopies tight to mounting surface.
   4. Suspended Lighting Fixture Support:
      a. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
      b. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
      c. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

O. Identify luminaires connected to emergency power system and install labels with panel and circuit numbers on concealed junction and outlet boxes in accordance with Section 26 05 53 - Identification for Electrical Systems.

P. Adjust aimable lighting fixtures as required to provide required light intensities.

Q. Adjust aimable heads of emergency lighting units as required to provide required light intensities along egress paths.

R. Connections:
   1. Connect wiring according to Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   2. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to their manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

S. Lenses, Louvers and Reflectors:
   1. Exercise particular care when installing fixtures and lamps in fixtures with specular reflector material to prevent smudging or damaging the reflector surface. Wear clean gloves as recommended by the fixture manufacturer.
   2. Do not install removable reflectors, louvers, diffusers, and decorative elements of lighting fixtures until completion of wet work, plastering, painting and general cleanup in the area of the fixtures, but not more than three days before date scheduled for inspections that establish date of Preliminary Acceptance.

T. Accessibility: Install equipment such as junction and pull boxes, fixture housings, transformers, remote drivers, switches and controls, and other apparatus that requires occasional maintenance to be accessible and appropriate for mounting and ceiling conditions.

U. Install fixtures in mechanical areas after ductwork and piping installation. Locate and mount fixtures as indicated on Drawings unless mechanical equipment prohibits or makes it impractical to do so. In such cases, chain or wall mount fixtures so that serviceable equipment is illuminated.

V. Locate recessed ceiling luminaires as indicated on Drawings. Mount fixtures at heights and locations indicated. Where heights are not indicated or conflicts exist, coordinate final locations with Architect/Engineer of Record.
W. In mechanical fan housings, locate fixtures so as not to interfere with belts, filters, and similar items.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.
B. Inspect each product for damage and defects.
C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy drivers as determined by Architect/Engineer of Record.

3.05 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 05 53 - Identification for Electrical Systems.

3.06 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect/Engineer of Record. Secure locking fittings in place.
B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect/Engineer of Record or authority having jurisdiction.
C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect/Engineer of Record or authority having jurisdiction.
D. After system checkout and adjustment, operate the system for the review of the Architect/Engineer of Record. Make adjustments or modifications as required by the Architect/Engineer of Record.

3.07 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
C. Training: Perform on-site training of personnel on operation, adjustment, and maintenance of interior lighting. Training shall last a minimum of 4 hours and at the end of the session, the maintenance personnel shall be thoroughly instructed in the proper operation of the system.
D. Demonstration: Demonstrate proper operation of luminaires to Architect/Engineer of Record, and correct deficiencies or make adjustments as directed.
E. Just prior to Preliminary Acceptance, replace all lamps that have failed.

3.09 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 51 00

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.
B. Drivers
C. Poles and accessories.
D. Luminaire accessories.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signal 2013 (Revised 2019).
C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements 2017.
D. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2010.
E. ANSI C136.41 - For Roadway and Area Lighting Equipment— Dimming Control Between an External Locking Type Photocontrol and Ballast or Driver 2013.
F. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2010e1.
G. Local Authority Building Code .
H. Municipal Code of the local authority.
I. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).
J. IEEE C2 - National Electrical Safety Code 2017.
K. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
L. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
M. IES RP-8 - Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting 2018.
N. IES TM-15 - Technical Memorandum: Luminaire Classification System for Outdoor Luminaires 2020.
O. NAAMM AMP 500-06 - Metal Finishes Manual 2006.
P. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
Q. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2006.
R. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
S. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.
T. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control Current Edition, Including All Revisions.
U. UL 1598 - Luminaires Current Edition, Including All Revisions.
V. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

A. The exterior lighting system shall include all lighting fixtures, LED modules, switches, mounting, wiring, control equipment, and accessories, whether or not they are indicated or specified, required for a complete system, as indicated in the Drawings and as specified.
B. The luminaire schedules in the Drawings indicate manufacturer, fixture design, appearance and performance desired.

1.04 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
B. Live Load: Single load of 500 lbs, distributed as stated in AASHTO LTS-4.
C. Ice Load: Load of 3 lbs/sq. ft. applied as stated in AASHTO LTS-4.
D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
    1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 110 mph.
    2. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. See Section 01 33 29 - LEED Sustainable Design Reporting, when required.
C. Shop Drawings:
    1. Include plans, elevations, sections, details, and attachments to other work.
    2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Include details that cannot be adequately represented to the satisfaction of the Architect/Engineer of Record in Product Data.
    3. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
    4. Wiring Diagrams: For power, signal, and control wiring.
    5. Photometric data, certified by the manufacturer in accordance with the recommended practices of the IES.
    6. Quantity and type of LED modules.
D. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Provide separate submittal product data/shop drawings for each fixture type clearly indicating the fixture type designation used in the Drawings and all pertinent options and accessories. Do not group similar fixture types together on a single cut sheet. Submittals that do not indicate option selection where multiple selections exist will be returned without review. Include data on features, accessories, finishes, and the following:
    1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
    2. Details of attaching luminaires and accessories.
    3. Details of installation and construction.
    4. Luminaire materials such as finish and color information.
    5. Photoelectric relays.
    6. LED Drivers: Include information as to input watts. Indicate mounting distance limitation and standard wire sizes for remote drivers. Indicate control type and range.
    7. LED modules, per luminaire tag, including life,
    lumen output, correlated color temperature (CCT), color rendering index (CRI) and energy-efficiency data.

8. Materials, dimensions, accessories and finishes of poles.
9. Photometric data based on laboratory tests of each luminaire type, complete with indicated LED modules, drivers, and accessories.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Pole and support structure anchor bolt information.
12. Manufactured pole foundations, if any.

E. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
1. Include BUG rating information
2. Include Efficacy information

F. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a State of Illinois Registered Structural Engineer.

G. Field Quality Control Reports.
1. Include test report indicating measured illumination levels.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

I. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals. Include manufacturers' recommended maintenance practices for each fixture type including, but not limited to, the following:
1. Tools required.
2. Acceptable cleaners and recommended cleaning practices.
3. Replacement parts list.
4. Manufacturer service department contact information/Qualified Service Agencies.
5. Submittal data.
6. Operation data.
7. Intended operation narrative.

J. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes. Submit record drawings of the actual installation within thirty (30) days of date of Preliminary Acceptance.

K. Re-Commissioning Data: Submit manual containing all information required for re-commissioning of the installations.
1. Submit two (2) copies of manual within thirty (30) days of date of Preliminary Acceptance.
2. Submit re-commissioning manuals in heavy-duty, 3-ring binders. Submit manuals in accordance with Section 01 78 00 - Closeout Submittals.

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Provide a manifest of all extra materials provided.
1. LED Modules: One (1) for every one hundred (100) of each type and rating installed. Furnish at least one (1) of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One (1) for every ten (10) of each type and rating installed. Furnish at least one (1) of each type.

3. Drivers: One (1) for every one hundred (100) of each type and rating installed. Furnish at least one (1) of each type.
4. Globes and Guards: One (1) for every twenty (20) of each type and rating installed. Furnish at least one (1) of each type.

1.07 QUALITY ASSURANCE

A. Comply with the local authority Building Code.
B. Comply with EPA, State of Illinois, and local regulations for proper recycling or disposal of existing lamps and ballasts removed from the Site.
C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the ANSI/IEEE 802.7 by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
G. Solid State Lighting/Luminaires:cps
    1. Luminous flux, luminaire efficiency and chromaticity shall be tested, measured and reported in accordance with the most current versions of IES LM-79 and IES LM-80.
    2. Chromaticity ranges for "white light" products, with various correlated color temperatures, shall be provided in accordance with ANSI/NEMA-C78.377.
    3. Drivers and power supplies shall be provided in accordance with the requirements of ANSI/NEMA-C82.SSL1, and their maximum allowable harmonic emission limits shall be in accordance with ANSI/NEMA-C82.77.
    4. Shall be provided with a U.S. Department of Energy (DOE) "Lighting Facts "label indicating their specific performance characteristics, tested and reported in accordance with the requirements of the most current version of IES LM-79.
H. Commissioning: When required for the Project, Contractor shall assign representative(s) with expertise and authority to act on its behalf. The representative(s) shall perform commissioning activities including, but not limited to, the following:
    1. Review submittals relative to exterior lighting systems being commissioned.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.
B. Store poles on decay-resistant-treated skids at least 12-inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
C. Handle poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4-inch deep. Do not apply tools to section of pole to be installed below ground line.
D. Retain factory-applied pole wrappings on metal poles until right before pole installation.
E. Deliver exterior lighting fixtures individually wrapped in factory-fabricated fiberboard type containers or equivalent.
F. Handle exterior lighting fixtures carefully to prevent breakage, denting and scoring the fixture finish. Do not install damaged lighting fixtures; replace and return damaged units to equipment manufacturer.
G. Store lighting fixtures in a clean, dry space. Store in original cartons and protect from dirt, physical damage, weather and construction traffic.

1.09 COORDINATION

A. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
B. Notify Architect/Engineer of Record of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
C. Verify locations of light fixtures indicated in Drawings and coordinate with other reference data and materials as required prior to installation to ensure locations will not interfere with underground utilities or openings. Alert Architect/Engineer of Record in writing to non-standard modifications required for compliance with the Contract Documents prior to proceeding with the work.
D. Where discrepancies are found within the Contract Documents, or additional information is required, immediately contact Architect/Engineer of Record for clarifications and additional information.
E. Coordinate installation of lighting system with other trades to prevent delays in the work and to ensure the lighting fixtures and supports will not be damaged by subsequent construction operations.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Special Warranty: Submit a written warranty, beginning from date of Preliminary Acceptance, and executed by the Contractor, manufacturer, and Installer agreeing to repair or replace products or components that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within the specified warranty period. Damage due to lightning, hail, vandalism, abuse, or unauthorized repairs or alterations shall be excluded from special warranty coverage. Warranty shall include all materials and components, as well as labor and equipment required to remove existing and install new materials and components.
    1. Warranty Period for LED Luminaires, including LED Modules, LED boards, chips, and Drivers: Five (5) years from date of Preliminary Acceptance.
    2. Warranty Period for Metal Corrosion: Five (5) years from date of Preliminary Acceptance.
    3. Warranty Period for Color Retention: Five (5) years from date of Preliminary Acceptance.
    4. Warranty Period for Fuses: Two (2) years from date of Preliminary Acceptance.
    5. Warranty Period for Poles: Three (3) years from date of Preliminary Acceptance. Warranty shall include pole finish.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Provide for proper recycling or disposal of existing lamps and ballasts removed from the site in accordance with EPA and State of Illinois regulations in accordance with Section 02 86 13 Hazardous and Universal Waste Management.

PART 2 – PRODUCTS

2.01 LUMINAIRES

A. Manufacturers:
    1. Products: Subject to compliance with requirements indicated and the design criteria specified in the Luminaire Schedule, provide one (1) of the products specified in the Luminaire Schedule.
B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
C. Provide products listed, classified, and labeled as suitable for the purpose intended.
    1. Fixtures that are aimed upward shall be listed and labeled for installation in wet locations in that position.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including LED modules, LED boards, drivers, reflectors, lenses, housings and other components required to position, energize and protect the light source and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc. Components, including nuts, bolts, rivets, springs, and similar parts, to be made from corrosion resistant materials.

H. Provide luminaires listed and labeled as suitable for wet locations and outdoor service unless otherwise indicated. Provide IP ratings required by fixture schedule, in compliance with IEC 60529.

I. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

K. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
   4. Shall be provided with a U.S. Department of Energy (DOE) "Lighting Facts "label indicating their specific performance characteristics, tested and reported in accordance with the requirements of the most current version of IES LM-79.
   5. Chromaticity ranges for "white light" products, with various correlated color temperatures, shall be provided in accordance with ANSI/NEMA -C78.377.
   6. LEDs shall be binned within a maximum 3-step MacAdam Ellipse.
   7. Drivers and power supplies shall be provided in accordance with the requirements of ANSI/NEMA-C82.SSL1 and their maximum allowable harmonic emission limits shall be in accordance with ANSI/NEMA-C82.77.

L. Provide anodized aluminum for aluminum parts of exterior fixtures that are not specified as requiring a painted finish.

M. Lateral Light Distribution Patterns: Comply with IES RP-8 for parameters of lateral light distribution patterns indicated for luminaires. Comply with IES TM-15.

N. Metal Parts: Free of burrs and sharp corners and edges.

O. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

P. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

Q. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit maintenance. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect driver when door opens.

R. Exposed Hardware: Stainless steel.
S. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
T. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
U. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
    1. White Surfaces: 85 percent.
    2. Specular Surfaces: 83 percent.
    3. Diffusing Specular Surfaces: 75 percent.
V. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
W. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
    1. Where luminaire products are not indicated to be field painted and are not indicated to match the finish process and color of pole or support materials, provide the following:
        a. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
            1) Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
            2) Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
X. Factory-Applied Labels: Comply with UL 1598. Include recommended LED modules and drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when fixture assemblies are in place.
    1. Label shall include the following LED module and driver characteristics:
        a. "USES ONLY" and include specific LED module type.
        b. CCT and CRI for all luminaires.
Y. Emergency Power: Provide emergency LED power pack with back box matching housing finish where indicated or, if not indicated, where required by Architect/Engineer of Record.

2.02 BALLASTS AND DRIVERS

A. Drivers - General Requirements:
    1. LED drivers shall be factory provided by the respective luminaire manufacturers, and shall be suitable for their intended use, to operate the designated LED modules listed in the Luminaire Schedule, and as specified herein, to their full light output.
    2. Comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
    3. Provide complete connection to LED-type luminaries through both integrally installed and remote electronic drivers.
    4. Shall be totally enclosed within a metallic enclosure, and shall be provided with integral leads color coded per ANSI C82.11, or with poke-in style wire retaining connectors.
    5. Provide identical drivers within each luminaire type.
    6. Provide UL listed and labeled drivers. Provide drivers with temperature ratings appropriate to the installation.

7. Surge Tolerance: Capable of withstanding characteristic surges, 10,000 aic minimum.
8. Fixtures intended to be dimmed shall have dimming driver compatible with the specified dimmer controls.
9. Remote Drivers:
    a. Remove drivers are specifically not indicated in Drawings. Install remove drivers in a readily accessible, dry, indoor, concealed location in accordance with the manufacturer's written instructions. If an indoor location is not within wiring distance limitations, an above grade, exterior enclosure rated as NEMA 3R or 4X is allowable. Enclosures shall be lockable, with a piano hinge design.
    b. Provide ventilated metal enclosures for remove drivers furnished as loose equipment. All wiring related to remove drivers and the related LED luminaries shall be installed in conduit.
    c. Verify and comply with the remote distance limitations specified by the luminaire/driver manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. Verify that field measurements are as indicated.
D. Verify that lighting fixture back-boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with ANSI/IEEE 802.7.
E. Verify that suitable support frames are installed where required.
F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

3.02 PREPARATION

A. Provide extension rings to bring lighting fixture back-boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
C. Demolition: Disconnect and remove luminaires, lamps, and accessories as indicated or, if not indicated, as directed by Architect/Engineer of Record. Disconnect and remove abandoned luminaires, lamps, and accessories. Remove from Site and dispose of legally.
D. Existing Installations: Extend existing installation using materials and methods specified.
E. Existing Fixtures to Remain or be Reinstalled: Clean and repair existing luminaires to remain and those indicated to be removed and reinstalled.

3.03 INSTALLATION

A. Coordinate locations of lighting fixture back-boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install products in accordance with manufacturer's instructions.
D. Install luminaires in accordance with NECA/IESNA 501.
E. Provide required support and attachment in accordance with Section 26 05 29.
F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
G. Recessed Luminaires:
    1. Install trims tight to mounting surface with no visible light leakage.

2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
1. Where fixtures protrude from the wall surface, provide additional structural support within the wall framing to accommodate the extra moment force created by the fixture

J. Install accessories furnished with each luminaire.

3.04 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33.13 - Conduit for Electrical Systems. In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a fifty (50) percent overlap.

3.05 RACEWAYS AND BOXES

A. Plastic conduit shall be used where indicated in Drawings, in unpaved areas and lawn areas. The conduit shall be Schedule 40, UL Listed, polyvinyl chloride conduit, and not less than 1-1/2 inches in diameter.

B. Galvanized rigid conduit shall be used under buildings, within five feet of entrances to buildings, in pole foundations, under paved areas and walkways, and within 18-inches, horizontally, of exterior junction boxes.

C. Provide pull line in empty conduit and duct.

D. Comply with the additional requirements of Section 26 05 33.13 - Conduit for Electrical Systems, 26 05 33.16 - Boxes for Electrical Systems, and 26 05 33.23 - Surface Raceways for Electrical Systems.

3.06 IDENTIFICATION

A. Provide vinyl tagging with panel source and circuit number on wiring at handhole in each pole and at each exterior box.

B. Identify each exterior box with 1-1/2 inch high black letters and numbers on yellow weatherproof, pressure-sensitive adhesive vinyl on the covers. Labels shall be Brady #1530.

C. Comply with the additional requirements of Section 26 05 53 - Identification for Electrical Systems.

3.07 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy drivers as determined by Architect/Engineer of Record.

E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.08 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect/Engineer of Record.

3.09 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.10 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Inspect each installed fixture for damage. Replace damaged fixtures and components.

D. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

E. Replace fixtures that show evidence of corrosion during project warranty period.

F. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with requirements.

G. Training: Perform on-site training of personnel on operation, adjustment, and maintenance of exterior lighting. Training shall last a minimum of 4 hours and at the end of the session, the maintenance personnel shall be thoroughly instructed in the proper operation of the system.

3.11 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.12 COMMISSIONING AND DEMONSTRATION

A. After system checkout and adjustment, the contractor shall operate the system for the review of Architect/Engineer of Record, and shall make all adjustments and modifications as required by Architect/Engineer of Record.

END OF SECTION 26 56 00

SECTION 31 13 00

TREE AND LANDSCAPE PROTECTION

PART 1 - - GENERAL

1.01 SECTION INCLUDES

A. Protection and trimming of trees that interfere with, or are affected by, execution of the Work.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.
   1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
   2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work.
      a. Require attendance by all affected installers including but not limited to
         1) Contractor's Superintendent
         2) Installer
         3) Manufacturer/Fabricator Representative
         4) Other affected Subcontractors
         5) Architect/Engineer of Record
         6) PBC Representative
   3. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, PBC and those affected by decisions made.

1.03 REFERENCE STANDARDS

A. FPDCC Tree Protection and Preservation Manual, March 2020.

B. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices; 2017.

C. ANSI Z133.1 - American National Standard For Arboricultural Operations - Pruning, Repairing, Maintaining, And Removing Trees, And Cutting Brush - Safety Requirements; 2012.

D. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012 (Reapproved 2017).

E. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping Purposes; 2013.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification: From a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From a Certified Arborist for care and protection of trees affected by construction during and after completing the Work.

1.05 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, Certified Arborist to Project site on a full-time basis during execution of the Work.

B. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located.

C. Tree Pruning Standards: Comply with ANSI A300 Part 1 unless more stringent requirements are indicated.

PART 2 - - PRODUCTS

2.01 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D5268. Provide topsoil that is free of stones larger than 1 inch in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi.
   1. Fencing fixed in position and meeting the following requirements. secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart
   2. Height: 4 feet
   3. Color: High-visibility orange, nonfading
   4. Gates: swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

PART 3 - - EXECUTION

3.01 EXAMINATION

A. The Contractor is responsible for ensuring the ongoing protection of all landscaped areas within the scope of work, including adjacent areas that may be impacted including access and egress routes. Existing landscaping including trees, shrubs, lawns, planting beds, etc. shall be adequately protected by the Contractor so as to avoid destruction and/or damage as a result of operations by the Contractor.

B. Before beginning work, the contractor will be required to meet with the Certified Arborist at the site to review all work procedures, access routes, storage areas, and tree and landscape protection measures.

C. Any proposed changes to agreed-upon work procedures, access routes, storage areas, and/or tree and landscape protection measures must be reviewed and approved by a Certified Arborist prior to implementation of any proposed changes.

3.02 PREPARATION

A. Tree and Landscape Protection Zones
   1. The location, limits and extent of tree and/or landscape protection zones are to be determined in the field by a Certified Arborist prior to any work being performed.
   2. Driving, parking, dumping, stockpiling and/or storage of vehicles, equipment, supplies, materials, debris, spoils, waste or washout water within tree and/or landscape protection zones is strictly prohibited.
   3. All underground utilities, drain and/or irrigation lines are to be routed OUTSIDE the landscape protection zone. If underground lines must traverse the protection area, they shall be tunneled or bored below the root zones.

B. Temporary Fencing: Install temporary fencing at the perimeter of Tree and Landscape Protection Zones as indicated by the Certified Arborist and the Forest Preserve.
   1. Fencing is to completely enclose all protected zones.
   2. All temporary fencing to be outside the drip line of trees.
   3. All tree and landscape protection fencing must be in place prior to any work being performed on site, including delivery of materials or supplies, vehicular traffic, installation of security fencing, etc.
   4. Tree and landscape protection fencing is to be maintained intact, by the Contractor, throughout the duration of the work and until all site work has been completed. Removal or relocation of protection fencing must be approved by a Certified Arborist. Fences may NOT be relocated or removed without the written permission of the Certified Arborist.
   5. All tree protection fencing must be placed per the Forest Preserves requirements.

C. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

D. Do not allow the following within the Tree and Landscape Protection Zones
   1. Storage of construction materials, debris, or excavated material.
   2. Activities that would result in soil compaction over root systems.
   3. Vehicular traffic.
      a. Where temporary haul or access routes must pass over the root area of trees to be retained, a 6-inch thick “access route” of an approved cushioning material shall be put in place to protect the root zones.
      b. The location and route of the temporary “access route” must be approved by the Certified Arborist prior to any work being performed.
      c. The “access route” material shall be replenished as necessary to maintain a uniform 6-inch depth.
      d. Vehicular traffic must be confined to the defined “access route.”

3.03 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction.
2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.04 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond drip line of trees. Maintain existing grades within drip line of trees, unless otherwise recommended by Certified Arborist.
1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.

C. Moderate Fill: Where existing grade is more than 6 inches, but less than 12 inches, below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
2. Place filter fabric with edges overlapping 6 inches minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.05 TREE PRUNING

A. All pruning shall be performed by a Certified Arborist.

B. Prune remaining trees affected by temporary and new construction and as indicated.

C. Prune remaining trees to compensate for root loss caused by damaging or cutting root system.

D. Prune trees according to ANSI A300 Part 1 and ANSI Z133.1.

E. Cut branches with sharp pruning instruments; do not break or chop.

F. Chip branches removed from trees. Spread chips where indicated or as directed by Architect/Engineer of Record.

3.06 TREE REMOVAL

A. All trees to be removed from within the project area shall be removed by a Certified Arborist.

B. Trees shall be cut near ground level and the stump ground out to a clear depth of eighteen inches below grade, or as otherwise specified.

C. Trees to be removed from project areas not within tree protection zones must be felled and removed in such a way as to avoid damage to trees and landscaping to remain.

3.07 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the Certified Arborist.
   1. Damage or injury to trees includes, but is not be limited to: breakage, gouging, stripping, skinning, inappropriate pruning or cutting to bark, limbs, branches, trunks and/or roots, and/or compaction, dumping or flooding of roots or root zones.

B. Remove and replace dead and damaged trees that the Certified Arborist determines to be incapable of restoring to a normal growth pattern.
   1. Provide new trees of the same size and species as those being replaced.
   2. If tree required to be replaced is more than 6 inches in caliper size, measured 12 inches above grade, provide new tree of 6-inch caliper size and of a species selected by Architect/Engineer of Record.

C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

3.08 CLEANING

A. Remove excess excavated material, displaced trees, and excess chips from site.

B. Burning is not permitted.

C. Remove all temporary fencing.

D. Remove all cushioning material installed for “access routes”. Material must be removed either by hand or with small bobcat-type machines. All of the material must be completely removed. Where small machinery is used to remove the bulk of the material, removal of material in contact with the soil surface must be done by hand, and in such a way as to minimize disturbance of the soil surface and prevent damage to surface or feeder roots.

E. Upon completion of work, the Contractor is responsible for ensuring that all landscaped areas within the scope of work, including adjacent areas that may have been impacted, are clean and free of trash or debris.

F. All existing landscaped areas are to be restored to their previous condition.

END OF SECTION 31 13 00

SECTION 31 20 00

EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Subbase course for concrete walks and pavements.
4. Subbase course and base course for asphalt paving.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:
1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Division 32 and 33 Sections.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and pavement/surface material.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the surface material that also minimizes upward capillary flow of pore water and also acts as serves to provide stormwater detention volume.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation

and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Structures: Buildings, footings, foundations, walls, slabs, curbs, vaults, manholes, catch basins, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for pavements.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

M. Illinois Department of Transportation [IDOT] Standard Specifications for Road and Bridge Construction [SSRBC]

1.04 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches (300 by 300 mm).
2. Warning Tape: 12 inches (300 mm) long; of each color.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698 and/or ASTM D 1557.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.05 QUALITY ASSURANCE

A. Blasting: Not Permitted

B. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

C. Pre-excavation Conference: Conduct conference at Project site.

1.06 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify utility locator service [DIGGER] for area where Project is located before beginning earth moving operations. Telephone (312) 744-7000.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Excavation or other digging unless otherwise indicated.
6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones or neighboring buildings.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: All materials shall comply with IDOT SSRBC and IEPA. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33; fine aggregate.

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

L. Refer to plans for specified gradations and other fill criteria.

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

2.04 COMPRESSIBLE FILL

A. Chemical resistant, ultraviolet stable, non-absorbent, low density, compressible for exterior application.

B. Polyethylene sheets, ASTM 4819

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

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

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to Division 1 specifications included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots from excavation operations.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades to establish proposed pavement section.

3.07 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of pipe as noted on plan.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearances as indicated on plan.

C. Trench Bottoms: Excavate trenches minimum 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.08 SUBGRADE INSPECTION

A. Notify Architect / Engineer when excavations have reached required subgrade. Schedule inspection with Qualified Testing Agent—see Field Quality Control.

B. If the Qualified Testing Agent determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes)] to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Other testing, such as density testing (ASTM 6938), may be used where proof-rolling is not feasible.

1. Completely proof-roll subgrade in one direction , repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Qualified Testing Agent or Architect / Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.09 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect / Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.010 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.011 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.012 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Refer to plans for backfill and gradation requirements.

C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact backfill in 8 inch lifts.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.013 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.014 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.015 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.016 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm)
2. Walks: Plus or minus 1/2 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.017 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.018 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.

3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect/Engineer.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 1000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 50 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 50 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.019 PROTECTION

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

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.020 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect/Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Asphalt pavement as indicated on the plan.
- B. Aggregate base course.
- C. Double course bituminous concrete paving.

1.02 REFERENCE STANDARDS
- A. AASHTO M 288 - Standard Specification for Geosynthetic Specification for Highway Applications 2022.
- B. ASBA - American Sports Builders Association Current Guidelines.
- C. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
- D. ASTM D1073 - Standard Specification for Fine Aggregate for Asphalt Paving Mixtures 2016 (Reapproved 2022).
- E. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples 2007.
- F. ASTM D2041/D2041M - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Asphalt Mixtures 2019.
- G. ASTM D2726/D2726M - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures 2017.
- H. ASTM D2950/D2950M - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods 2014.
- I. ASTM D3549/D3549M - Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimens 2017.
- J. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal 2015.
- K. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements 2015.
- L. ASTM D979 - Standard Practice for Sampling Bituminous Paving Mixtures 2015.

1.03 ADMINISTRATIVE REQUIREMENTS
- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
  1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
  2. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  3. Review condition of subgrade and preparatory work.
  4. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
  5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  6. Require attendance by all affected installers including but not limited to
     a. Contractor's Superintendent

b. Installer
c. Manufacturer/Fabricator Representative
d. Other affected Subcontractors
e. Architect/Engineer of Record
f. PBC Representative

7. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect/Engineer of Record, PBC and those affected by decisions made.

1.04 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures.
B. Product Data: Provide product data for each product specified.
C. Job-Mix Designs: For each job mix proposed.
   1. Job-mix design documentation shall include the amount of RAP material, by percentage of total mix, to be utilized.
   2. Job-mix design documentation shall clearly indicate source/origin of RAP material.
D. Qualification Data: For IDOT qualified manufacturer and installer.
E. Material Certificates: For each paving material, from manufacturer.
F. Material Test Reports: For each paving material and mix.
G. Compliance with Coal Tar Sealant Disclosure Act: Provide a letter confirming compliance with State of Illinois Department of Public Health (410 ILCS 170/) Coal Tar Sealant Disclosure Act.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Illinois Department of Transportation (IDOT) "Standard Specifications for Road and Bridge Construction".
   1. Measurement and payment provisions and safety program submittals included in IDOT Standard Specifications do not apply to this Section.
B. Obtain materials from same source throughout.
C. Manufacturer Qualifications: Hot mix asphalt manufacturer shall have valid and current IDOT approvals for materials and work specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement marking materials to project site in in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.07 FIELD CONDITIONS

A. Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met. Temperatures are to be taken in the shade, away from exposed pavement and stone aggregate fill and other artificial heat sources.
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Slurry Coat: Comply with weather limitations in ASTM D3910.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   4. Asphalt Binder Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate for Base Course: Complying with requirements of IDOT Standard Specifications, Section 311, for type B base course with gradation CA-6 crushed stone.
B. Hot-mix Asphalt Surface Course: Complying with IL-9.5L, Ndes = 50 of the IDOT Standard Specifications.
C. Hot-Mix Asphalt Binder Course: Complying with IL-19L, Ndes = 50 of the IDOT Standard Specifications.
D. Reclaimed Asphalt Pavement (RAP): RAP, complying with IDOT Standard Specifications, specifically 9/17/17 Memorandum "Special Provision for Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS)" as applies to work in this section.
    1. RAP material shall be free of contamination, including, but not limited to, dirt, sand, brick, debris, concrete, sheet asphalt, sealant materials, and clean stone.
E. Sand: ASTM D1073, Grade Nos. 2 or 3.
F. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
G. Joint Sealant: ASTM D6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
B. Verify gradients and elevations of base are correct.
C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of sub-grade and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 AGGREGATE BASE COURSE

A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.
B. Place and compact base course. Base course shall have a minimum Illinois Bearing Ratio (IBR) of 2.5 and comply with requirements of IDOT Standard Specifications, Section 301. Subgrade shall be proof-rolled in accordance with Division 31 section “Earthwork”.

3.03 PREPARATION - PRIMER

A. Apply primer in accordance with manufacturer's instructions.
B. Apply primer on aggregate base or subbase at uniform rate of 0.25 - 0.50 gal/sq yd. Apply enough material to penetrate and seal, but not flood surface. Allow prime coat to cure before applying hot-mix asphalt paving.
C. Use clean sand to blot excess primer. Remove loose sand before pavement is placed and after volatiles have evaporated.

3.04 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.
B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.1 gal/sq yd.
C. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
D. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
E. Prohibit traffic across tack coat for period not less than that required by manufacturer.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Install Work in accordance with Illinois Department of Transportation (IDOT) "Standard Specifications for Road and Bridge Construction" Section 406 and 407.
B. Machine-place asphalt binder course within 24 hours of applying primer or tack coat.
C. Machine-place wearing course within two hours of placing binder course.
D. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
    1. Place hot-mix asphalt base course/wearing course in two lifts and thicknesses indicated.
    2. Spread mix at minimum temperature of 250 deg F.
    3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
    4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
    5. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
        a. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
    6. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.06 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course. Joints between successive days' work shall be constructed to ensure thorough and continuous bond between the newly and previously placed paving.
    1. Clean contact surfaces and apply tack coat to joints.
    2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
    3. Offset transverse joints, in successive courses, a minimum of 24 inches.
    4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to the Asphalt Institute MS-22, "Construction of Hot-Mix Asphalt Pavements," for both "Ending a Lane" and "Resumption of Paving Operations."
    5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
    6. Compact asphalt at joints to a density within two percent (2%) of specified course density.

3.07 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
    1. Complete compaction before mix temperature cools to 185 deg F.
B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D2041/D2041M, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Frames of subsurface structures:
1. Coat surfaces of new and existing frames with oil to prevent bond with asphalt paving.
2. Set cover rings to be flush with finish surface and surround with a ring of compacted asphaltic concrete to one inch below top of frame. Adjust as required to meet paving.
3. Provide temporary covers over openings until completion of rolling operations

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and sufficiently hardened, as determined by the Architect/Engineer of Record.

I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.08 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

D. Above tolerances are allowed but subject to conditions:
1. The asphalt pavement surface slopes (walkways, pavements, parking lots) for accessibility shall not be exceeded.
2. The asphalt pavement shall drain as intended per plans and asphalt pavement placed shall not cause any water ponding.
3. If the above conditions are not complied, the contractor shall remove and replace portions(s) of the asphalt pavement to meet the required conditions.

3.09 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.

B. The owner will engage a qualified testing agency to perform quality assurance tests and inspections as follows:
1. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549/D3549M.
2. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with specified tolerances.
3. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979.
a. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041/D2041M, and compacted according to job-mix specifications.
b. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726/D2726M.
1) Take one core sample for every 1,000 square yards or less of installed pavement, with no fewer than three (3) core samples taken.

2) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950/D2950M and correlated with ASTM D1188 or ASTM D2726/D2726M.

4. Testing agency shall perform quality control testing per IDOT specifications and provide test reports.

C. Replace and compact hot-mix asphalt where core tests were taken.

D. Remove and replace and/or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 32 12 16

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete paving at sidewalks, pavements, integral curbs, curbs, curbs and gutter, driveways, curb ramps, and other concrete paving indicated.

1.02 REFERENCE STANDARDS

A. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.
B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
C. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.
D. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete 2016.
E. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).
F. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.
G. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).
H. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
I. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

1.03 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures.
B. Product Data: Provide data on joint filler, admixtures, and curing compound as applicable.
C. Laboratory Test Reports: Submit 2 copies of laboratory test reports to concrete materials and mix design tests.
D. Delivery Tickets: Submit copies of delivery tickets for each load of concrete delivered to the site.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Illinois Department of Transportation (IDOT) "Standard Specifications for Road and Bridge Construction" and the City of Chicago.
    1. Measurement and payment provisions and safety program submittals included in IDOT Standard Specifications do not apply to this Section.
B. Obtain materials from same source throughout.
C. Concrete Testing: The owner will employ a separate testing laboratory to perform initial field quality control testing.
    1. Materials and installed work may require testing and retesting at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all

times. Retesting of rejected materials and installed Work shall be done at the Contractor's expense.

2. Three concrete test cylinders shall be taken for every 75 cu. yds. or less of each class of concrete placed each day.
3. One additional test cylinder shall be taken during cold weather and be cured on site under same conditions as concrete it represents.
4. One slump test shall be taken for each set of test cylinders taken.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Comply with IDOT Specifications, Article 1103.05.

2.02 REINFORCEMENT

A. Reinforcing Steel: Comply with IDOT Specifications, Article 1006.10.
B. Steel Welded Wire Reinforcement: Comply with IDOT Specifications, Article 1006.10.
C. Tie wire: Annealed steel, minimum 16 gauge size.
D. Dowels (Concrete Pavement with Vehicular Traffic): Comply with IDOT Specifications, Article 1006.11.
E. Dowels (Concrete Pavement with Foot Traffic): Comply with IDOT Specifications, Article 1006.06.

2.03 CONCRETE MATERIALS

A. Comply with IDOT Specifications, Article 1020.
B. Obtain cementitious materials from same source throughout.
C. Air-Entraining Admixtures: ASTM C260/C260M.
D. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing and Type C - Accelerating.
    1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.04 ACCESSORIES

A. Curing Compound: Comply with IDOT Specifications, Article 718.04; ASTM C309, Type 1, Class A.
B. Liquid Surface Sealer: ASTM D3405.
C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
    1. Material: ASTM D1751, cellulose fiber.

2.05 CONCRETE MIX DESIGN

A. Comply with IDOT Specifications, Article 1020.
B. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended by manufacturer.
    1. Use accelerating admixtures in cold weather only with prior written approval from Architect/Engineer of Record. Use of admixtures will not relax cold weather placement requirements.
    2. Add air entraining agent to concrete mix for concrete work subject to freeze/thaw cycling and exposed to exterior.

C. Concrete Properties:
   1. Compressive strength, when tested in accordance with ASTM C39/C39M at 14 days; 3500 psi.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Owner's testing agency shall verify compacted subgrade is acceptable and ready to support paving and imposed loads.
B. Verify gradients and elevations of base are correct.
C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of sub-grade and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.02 SUBBASE

A. Comply with IDOT Specifications, Article 420.04.
B. Proofroll areas under drives and parking areas.
C. Provide additional fill for soft spots and hollows.
D. Level and Compact subgrade, to receive granular base for concrete work, to 95% Modified Proctor Density.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.
B. Notify Architect/Engineer of Record minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.
B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

A. Place reinforcement at midheight of slabs-on-grade except where otherwise indicated.
B. Interrupt reinforcement at contraction and expansion joints.
C. Place dowels to achieve pavement and curb alignment as detailed.
D. Provide doweled joints 12 inch on center, except where otherwise indicated, at interruptions with one end of dowel set in capped sleeve to allow longitudinal movement.

3.06 PLACING CONCRETE

A. Comply with IDOT Specifications, Articles 420 and 606.
B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.07 JOINTS

A. Align curb, gutter, and sidewalk joints.

B. Place expansion joints at 20 foot intervals, except where otherwise shown, and to separate paving from vertical surfaces and other components and in pattern indicated.
C. Provide scored joints.
   1. At 5 feet intervals except where otherwise shown.

3.08 CURING

A. Curing and protection shall be as outlined in IDOT Specifications, Articles 1020.13 and 1022. Color lithochrome color wax matching the colored concrete as manufactured by L.M. Schofield Company or approved equal, and applied in accordance with the manufacturer's written instructions; or white pigmented curing compound as outlined in IDOT Specification, Article 1022.01.c are the preferred curing methods. White-opaque polyethylene film shall not be accepted as a curing method.

3.09 FINISHING

A. Area Paving: Wood float.
B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
D. Accessible curb ramps: The detectable warning used shall be from the Chicago Department of Transportation list of approved detectable warning products (available on the City of Chicago website). It is not acceptable to install two different detectable warning products adjacent to one another at any location. The detectable warning must cover full width of the ramp excluding side flares for a minimum unobstructed depth of 24" . The detectable warning shall comply with ADA Standards and the pattern to be continuous throughout the ramp width and side flares at each location.
E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 TOLERANCES

A. Formed concrete having any dimension smaller or greater than required, and outside the specified tolerance limits, will be considered deficient in strength and subject to additional testing as herein specified.
B. Formed concrete having any dimension greater than required will be rejected if the appearance or function of the structure is adversely affected, or if the larger dimensions interfere with other construction. Repair, or remove and replace rejected concrete as required to meet the construction conditions. When permitted, accomplish the removal of excessive material in a manner to maintain the strength of the section without affecting function and appearance.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.
   2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
   3. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

4. Retesting of rejected materials and installed Work shall be done at the Contractor' s expense.

B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 75 cu yd or less of each class of concrete placed each day.
   1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
   2. Perform one slump test for each set of test cylinders taken.
   3. Test one specimen at 7 days, three at 14 days and one at 28 days if 14-day compressive strength has not yet been obtained.
   4. A compressive-strength test shall be the average compressive strength from the specimens obtained from same composite sample and tested at age indicated.
   5. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
   6. If 14-day strength does not meet the above criteria and reached strength at 28-day then concrete can remain in place.
   7. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the PBC Representative or Architect/Engineer of Record. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by the PBC Representative or Architect/Engineer of Record. If coring is performed, the section(s) of concrete cored will require removal & replacement and this removal & replacement of the section(s) will be done at the contractor's expense. It will be the contractor's responsibility to pay for this additional testing to the Testing and Inspecting agency.

C. Test results shall be reported in writing to Architect/Engineer of Record, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 14 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 14-day tests.

D. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

E. Defective Work: Concrete work which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense, without extension of time therefore. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION 32 13 13