SECTION 087100 - DOOR HARDWARE

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. Mechanical door hardware for the following:

    a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Requirements:

1. Section 083113 "Access Doors and Frames" for access door hardware, except cylinders.
2. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
3. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware and gasketing not specified in this section.
4. Section 087113 "Automatic Door Operators" for low-energy power operators and low-energy power-assist operators.

1.03 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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1. Conference participants shall include Owner, Architect, Contractor, Access Control Subcontractor, Installer's Architectural Hardware Consultant and Owner's security consultant.

    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Owner and Installer's Architectural Hardware Consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

    a. Flow of traffic and degree of security required.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.
    d. Requirements for access control.
    e. Address for delivery of keys.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.
3. Schematic diagram of systems that interface with electrified door hardware.

    a. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

4. Elevations of doors controlled by electrified door hardware.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.

    a. Number and date each page of schedule.
    b. Double space content to allow for reviewer comments.

3. Content: Include the following information:

    a. Identification number, location, hand, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

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1.08 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) or an Electrified Hardware Consultant (EHC) or Architectural Openings Consultant (AOC).

1.09 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.010 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Exit Devices: Three years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated.

2.02 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design" and the Indiana Building Code.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.03 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3 ”Door Hardware Schedule” at the end of this section.

B. Door Hardware Sets: Provide quantity, item, size, finish, or color indicated, and Basis-of-Design Products or products equivalent in function and comparable in quality to Basis-of Design products from listed alternate manufacturers.

C. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

D. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated by Basis-of-Design Products and technical

requirements in Part 2, as well as additional information in Part 3 "Door Hardware Schedule" Article.

1. Basis-of-Design Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements for design, type, quality and function. Refer to Section 016000 Product Requirements. Where only the manufacturer is listed as the Basis-of-Design, specific product references are provided in Part 3 "Door Hardware Schedule" Article.

2. References to BHMA Designations: Indicated to establish minimum requirements for quality, and function.

2.04 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hager Companies; 1191, 1279, BB1191, BB1279, BB1199 or a comparable product by one of the following manufacturers. Refer to Part 3 "Door Hardware Schedule" Article for additional requirements.

    a. Allegion plc.
    b. Bommer Industries, Inc.
    c. Lawrence Hardware Inc.
    d. McKinney Products Company; an ASSA ABLOY Group company.
    e. PBB, Inc.
    f. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2. Size: 4-1/2 by 4-1/2 unless noted otherwise in Part 3 “Door Hardware Schedule” Article.
3. Quantity: Provide the following unless otherwise indicated:

    a. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).

4. Hinge Weight: Unless otherwise indicated, provide the following:

    a. Entrance Doors: Heavy-weight ball-bearing hinges.
    b. Doors with Closers: Five Knuckle ball-bearing hinges.
    c. Interior Doors: Standard-weight hinges.

5. Hinge Base Metal: Unless otherwise indicated, provide the following:

    a. Interior Hinges: Brass with stainless-steel pin body and brass protruding heads.

6. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

    a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications.

        1) Outswinging corridor doors with locks.

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b. Corners: Square.

7. Electrified Hinges: Standard-weight ball-bearing hinges.

a. Conceal conductors in hinge body.
b. Provide 10 continuous electrical conductors.
c. Locate electrified hinges at center hinge location.

8. Fasteners: Comply with the following:

a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
b. Wood Screws: For wood doors.
c. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
d. Screws: Phillips flat-head screws. Finish screw heads to match surface of hinges.

2.05 SELF-CLOSING HINGES

A. Self-Closing Hinges: BHMA A156.17.

1. Basis-of-Design Product: Subject to compliance with requirements, provide PBB LE51 Cam Lift Mortise Hinge or a comparable product by one of the following manufacturers. Refer to Part 3 "Door Hardware Schedule" Article for additional requirements.

a. American Builders Hardware Manufacturing; A950.

2.06 CENTER-HUNG AND OFFSET PIVOTS

A. Center-Hung and Offset Pivots: BHMA A156.4.

1. Offset Pivot Basis-of-Design Product: Subject to compliance with requirements, provide Rixson Specialty Door Controls; an ASSA ABLOY Group company; Model 195 top and bottom pivot set with M19 intermediate pivot; or a comparable product by one of the following:

a. Allegion plc.
b. DORMA USA, Inc.
c. Hager Companies.

2.07 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hager Companies ; Series 780 series, or a comparable product by one of the following

manufacturers. Refer to Part 3 "Door Hardware Schedule" Article for additional product design requirements.

a. Allegion plc.
b. Bommer Industries, Inc.
c. McKinney Products Company; an ASSA ABLOY Group company.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.
e. Select Hinges.
f. Zero International, Inc.

2.08 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts as follows:

1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
2. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated by manufacturer’s model designation in Basis of Design definitions.
2. Levers: Wrought, Forged or Cast.
3. Escutcheons (Roses): Wrought or Forged.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied trim or where required by door inset on aluminum framing.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following manufactures. Function and additional product design requirements are specified in the "Door Hardware Schedule" in Part 3 of this section.:

a. Allegion; Schlage (L9000, Lever 03, Rose B)
1) Doors with Special Privacy Function in Hardware Schedule; L9496 with sectional indicator on outside of door with “Vacant/Occupied’ text (L283-722).
2) Doors with Electrified Lockset in Hardware Schedule; L9092EU.

b. Corbin Russwin, Inc.; an ASSA ABLOY Group company. (ML 2000, LWA)
   1) Doors with Special Privacy Function in Hardware Schedule; ML2065 with ML190 sectional indicator on outside of door with “Vacant/Occupied’ text (V50).
   2) Doors with Electrified Lockset in Hardware Schedule; ML20606

2.09 AUXILIARY LOCKS

A. Surface Mounted Auxiliary Locks: Sliding stainless steel bolt released by standard mortise cylinder to lock door. Solid aluminum case. Through bolt mounting..

1. Basis-of-Design Product: Subject to compliance with requirements, provide Progressive Hardware Co., Inc R1000 Drop Bolt Lock with cylinder specified in this specification section.

2.010 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; IVES FB 358 for wood or fiberglass doors; FB457 for metal doors, or a comparable product by one of the following:

   a. Burns Manufacturing Incorporated.
   b. Door Controls International, Inc.
   c. Hiawatha, Inc; a division of the Activar Construction Products Group.
   d. Trimco.

2.011 DUSTPROOF STRIKES

A. Dustproof Strikes: BHMA A 156.16, Grade 1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives DP2; or comparable product by one of the following:

   a. Burns Manufacturing Incorporated.
   b. Door Controls International, Inc.
   c. Hiawatha, Inc.
   d. Trimco

2.012 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Von Duprin, 98 Series with #697 Pull, #03 lever and cylinder dogging where noted in hardware sets or a comparable product by one of the following:

2.013 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Best Access Systems; Stanley Security Solutions, Inc.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.014 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Existing System:

a. Review lock system with Owner and provide keyways and pins coordinated with master, grand master, great-grand master, etc. keying as necessary to integrate new locks into Owner’s existing system.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver or Brass as selected by Owner.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following keys aligned with the key level determined by the final site key system:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.
d. Great-Grand Master Keys: Five.

2.015 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Key Boxes and Cabinets.
b. GE Security, Inc.

c. HPC, Inc.
d. Lund Equipment Co., Inc.
e. MMF Industries.
f. TelKee; Oasis International.

2. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.016 OPERATING TRIM

A. Swinging Door Operating Trim: BHMA A156.6; brass, bronze, stainless steel, as noted by Basis-of-Design product or finish indicated in Part 3 "Door Hardware Schedule" Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Rockwood Manufacturing Company; an ASSA ABLOY Group company product listed below or a comparable product by one of the Alternate Manufacturers:

a. Building Entry Push: RM3341; 1 1/4” dia, 30 inch CTC at east vestibule, 36 inch CTC at west vestibule.
b. Building Entry Pull: RM3341, 1 1/4 inch diameter, 70 1/4 inch top to bottom bracket CTC, intermediate bracket located to not conflict with cylinder location. 71 1/2 inch overall length.

2. Alternate Manufacturers

a. Burns Manufacturing Incorporated. VP 4221

B. Sliding Door Operating Trim: BHMA A156.6; brass, bronze, stainless steel, as noted by Basis-of-Design product or finish indicated in Part 3 "Door Hardware Schedule" Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Trimco 1110 Series Flush Pull, 1110-18 (18 inch by 2 1/2 inch).

2.017 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with cast iron body, adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; LCN Closers, 4040 Series, or a comparable product by one of the following manufacturers. Provide accessories such as Spring Cush Arm (integral stop) or Hold Open Arm (hold open) where indicated in the "Door Hardware Schedule" in Part 3 of this section.

a. Norton Door Controls; an ASSA ABLOY Group company. (9500 series)

2.018 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives product listed below or a comparable product by one of the Alternate Manufacturers:

a. Wall Stop: WS406CCV or WS407CCV.
b. Floor Stop: FS 13.
c. Vestibule Floor Stop: FS410.
d. Exterior Wall Stop/Holder: WS20X.

2. Alternate Manufacturers:

a. Architectural Builders Hardware Mfg., Inc.
b. Burns Manufacturing Incorporated.
c. Emtek
d. Hager Companies.
e. Hiawatha, Inc.
f. Rockwood Manufacturing Company.
g. Stanley Commercial Hardware.
h. Trimco.

2.019 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Adhesive-Backed Perimeter Gasketing: Vinyl bulb gasket material applied to frame rabbet with self-adhesive. Gasketing applied to head and jamb of frame, forming seal between door and frame.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International product indicated below or a comparable product by one of the Alternate Manufacturers:

a. Weatherstripping: 188S-Wh.
b. Soundstripping: 188S-Wh.

2. Alternate Manufacturers:

a. Hager Companies, (726W).
b. National Guard Products, Inc., (5050W)
c. Pemko Manufacturing Co., (PK55).
d. Reese Enterprises, (797-W)

C. Astragal Gasket for Meeting Stiles: Gasket material held in place by aluminum housing; mounted with screws.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International product indicated below or comparable product by one of the Alternate Manufacturers:

a. Fiberglass Doors, Where “magnetic meeting stile gasket” indicated: Self adjusting, magnetic, surface mounted on exterior face of door. (375A, 2 required)
b. Adjustable Door Sweep: Pile type, spring loaded, screw adjustable, surface mounted on exterior face of door. (255)

2. Alternate Manufacturers:

a. Hager Companies.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
d. Reese Enterprises.

D. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:

1. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
2. Gasketing on Double Doors: 0.50 cfm per foot (0.000774 cu. m/s per m) of door opening.

2.020 THRESHOLDS

A. General

1. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch(13 mm) high.

B. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International products indicated in schedule or a comparable product by one of the following manufacturers. Additional product design requirements are specified by product number in the “Door Hardware Schedule” in Part 3 of this section:

a. National Guard Products, Inc.
b. Pemko Manufacturing Co.
c. Reese Enterprises, Inc.

2.021 SLIDING DOOR HARDWARE

A. Sliding Door Track Assembly: Consisting of complete sets including rails, door trolleys, track hanger and spacers, valences, guide channels, floor guides, and accessories indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hafele Slido D-Line 11 120P system, including but not limited to the following components:

a. Door Track: Continuous length: Silver colored anodized aluminum, 32 mm height, rated for maximum of 264 pounds, 6 meter length (941.25.606).
b. Ball Bearing Mounted Roller Running Gear: Provide each door panel with 2 running gears.

1) One, soft, self-closing mechanism and release device.
2) One, with shock absorber with retaining spring.

3) Set with plastic door guide. Guide not used. (941.02.038). Two sets per opening required.

c. Track Spacer for 1-3/4 inch Door Thickness: Silver colored anodized aluminum, 19 mm wide, 3 meter lengths (941.25.833) Two lengths required per opening.
d. Track Clip-On Fascia: Silver colored anodized aluminum, 68 mm tall by 22.5 mm wide, 6 meter length (940.43.260)
e. Track End Caps: Silver colored plastic end caps (941.25.035). Two caps required per opening.
f. Metal Floor Guide Track: Aluminum, mill finish (940.42.203)

1) Install in bottom channel of door with stainless steel flat head screws, countersink in rail, and spacers as required.

g. Floor Guide Roller: Galvanized Steel (940.42.032) Two guides required per opening.

2. Aluminum Bar Spacer: 1 inch by 2 inch solid aluminum bar, 6063 Alloy.

a. Anchors to Masonry: Lag shield anchors with stainless steel flat head screws.

2.022 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick aluminum, brass, bronze, or stainless steel as noted by Basis-of-Design product or finish indicated in Part 3 “Door Hardware Schedule” Article; with manufacturer’s counter-sunk machine or self-tapping screw fasteners.

B. Size: 1- inch (25 mm) less than door width on push side and 1/2 inch(13 mm) less than door width on pull side, by height specified.

C. Isolate brass or bronze units from hollow metal doors to prevent electrolytic oxidation of protective trim.

D. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives product listed below or a comparable product by one of the Alternate Manufacturers:

1. Kick Plate: 8 inch height; 8400 B4E/CS.
2. Door Armor: 30 inch height, 8400 B3E/CS.

3. Alternate Manufacturers:

a. Burns Manufacturing Incorporated.
b. Hager Companies.
c. Hiawatha, Inc; a division of the Activar Construction Products Group.
d. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
e. Trimco.

2.023 AUXILIARY DOOR HARDWARE

A. Silencers for Metal Door Frames: Grade 1; neoprene or rubber; minimum diameter 1/2 inch (13mm); fabricated for drilled-in application to frame.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives SR 64 or comparable product by one of the following:

    a. Architectural Builders Hardware Mfg., Inc.
    b. Burns Manufacturing Incorporated.
    c. Hager Companies.
    d. Trimco.

2.024 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Door and Frame Electrical Power Transfer (EPT):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc, Von Duprin EPT 10 or comparable product by one of the following:

    a. Precision Hardware, Inc.; a Stanley company.

B. Door Position Switch: Concealed mount, flush mount electromagnetic sensing device mortised in head of door frame and top edge of door.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Schlage 7764 or comparable product by one of the following:

    a. Securitron Magnalock Corp.; an ASSA ABLOY Group company (MSS 1-C).

2.025 FABRICATION

A. Manufacturer’s Nameplate: Do not provide products that have manufacturer’s name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer’s identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer’s standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.026 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer’s written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Key Control System:

1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
3. Key Control System Software: Set up multiple-index system based on final keying schedule.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 “Joint Sealants.”

H. Stops: Provide stops for doors unless otherwise indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Adjustable Door Sweeps: Apply to bottom of door. Adjust to form seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.06 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.07 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

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3.08 DOOR HARDWARE SCHEDULE

PUSH/PULL HARDWARE SETS.

Door Hardware Set No. : PP 1

Qty.	Item	Additional Information	Finish
2	Offset Pivot Set		Match Door and Frame
2	Entry Push		US 32D
2	Entry Pull		US 32D
1	Power Door Operator	Operates one door of pair. Specification Section 087113 Power Door Operators	Match Door and Frame
1	Concealed Closer	Provided with power door operator, mounted in head extrusion, with arm coordinated with door type	NA
2	Vestibule Floor Stop		US 26D
	Weatherstripping	By Frame Manufacturer	

ENTRANCE HARDWARE SETS.

Door Hardware Set No. : ENT 1

Qty.	Item	Additional Information	Finish
1	Continuous Hinge		Match Door and Frame
1	Lockset	Office Function (F20) Mortise Lockset	US 26D
1	Surface Closer	Integral Stop Arm	ANSI 689
1	Kickplate		US 32 D
1	Weatherstripping		White
1	Threshold	Entrance; 65A	Mill
1	Adjustible Sweep		AA

CLASSROOM HARDWARE SETS.

Door Hardware Set No. : C 1

Qty.	Item	Additional Information	Finish
	Hinges		US 26D
1	Lockset	Classroom Function (F05) Mortise Lockset	US 26D
1	Wall Stop		US 26D
1	Kickplate	Install on terrazzo floor side of door	US 32D
1	Threshold	Entrance; 65A	Mill
1	Soundstripping		White

ELECTRIC LOCK HARDWARE SETS.

Door Hardware Set No. : EL1

Qty.	Item	Additional Information	Finish
2	Hinges		US 26D
1	Electric Hinge		US 26D
1	Electrified Lockset	Fail Secure	US 26D
1	Surface Closer	Integral Stop Arm	ANSI 689
1	Kickplate	Install on terrazzo floor side of door	US 32D

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1	Wall Stop		US 26D
1	Soundstripping		White
1	Threshold	Terrazzo to concrete transition; 1545	Mill
1	Door Position Switch		
1	Card Reader	(By Allowance)	

Door Hardware Set No. : EL1A
Same as set EL1, except omit threshold

Door Hardware Set No. : EL2

1	Continuous Hinge		Match door color
1	Electrical Power Transfer	EPT-10	ANSI 689
1	Electrified Lockset	Fail Secure	US 32D
1	Surface Closer	Integral Hold Open/Stop Arm	ANSI 689
1	Door Armor Plate		US 32D
1	Wall Stop		US 32D
1	Weatherstripping		White
1	Threshold	Entrance; 65A	Mill
1	Adjustable Sweep		AA
1	Door Position Switch		
1	Card Reader	(By Allowance)	

Door Hardware Set No. : EL3

2	Continuous Hinge	Wide Throw; 780-235-HD	Match door color
1	Electrical Power Transfer	EPT-10	ANSI 689
1	Electrified Lockset	Fail Secure	US 32D
1 set	Flush Bolts		US 26D
1	Dustproof Strike		US 26D
1	Surface Closer		ANSI 689
2	Exterior Wall Stop/Holder		US 28
2	Door Armor Plate		US 32D
1	Magnetic Meeting Stile Gasket		AA
1	Weatherstripping		White
1	Threshold	Entrance; 65A	Mill
2	Adjustable Sweep		AA
2	Door Position Switch		
1	Card Reader	(By Allowance)	

PRIVACY HARDWARE SETS.

Door Hardware Set No. : PR 1

Qty.	Item	Additional Information	Finish
3	Gravity Hinges		US 26D
1	Lockset	Privacy Function (F21) Mortise Lockset	US 26D
1	Wall Stop		US 26D

Door Hardware Set No. : PR 2 (Family Restroom Door)

Qty.	Item	Additional Information	Finish

	Hinges		US 26D
1	Lockset	Special Privacy Function (Key Retracts Deadbolt, Occupied Indicator) Mortise Lockset	US 26D
1	Surface Closer		ANSI 689
2	Kickplate	Install on each side of door	US 32D
1	Wall Stop		US 26D

Door Hardware Set No. : PR 3

Qty.	Item	Additional Information	Finish
1	Continuous Hinge		US 26D
1	Lockset	Special Privacy Function (Key Retracts Deadbolt, Occupied Indicator) Mortise Lockset	US 26D
1	Surface Closer	With Integral Stop Arm	ANSI 689
1	Weatherstripping	By Frame Manufacturer	
1	Threshold	Entrance; 65A	Mill
1	Adjustable Sweep		Mill

EXIT DEVICE HARDWARE SETS.

Door Hardware Set No. : E 1 (Aluminum Pair Exterior Entrance Door)

Qty.	Item	Additional Information	Finish
2	Offset Pivot Sets		US 32D
1	Exit Device	9848NL – OP, LBR, CD	US 32D
1	Exit Device	9848EO - CD	US 32D
1	Power Door Operator	Operates one door of pair. Specification Section 087113 Power Door Operators	Match Door and Frame
1	Concealed Closer	Provided with power door operator, mounted in head extrusion, with arm coordinated with door type	
2	Entry Pulls		US 32D
2	Vestibule Floor Stop		US 26D
	Weatherstripping	By Frame Manufacturer	
	Meeting Stile Weatherstripping	By Door Manufacturer, fixed in edge of door with screw.	
1	Threshold	Entrance; 65A	Mill

Operation of Hardware Sets PP3 and E4: Both doors of pair normally unlocked/dogged. Power door operator activates one door of pair upon knowing action of pressing operator button. After a timed delay, the second operator in the sequence of vestibule openings begins operation of one door of second pair.

SLIDING DOOR HARDWARE SETS.

Door Hardware Set No. : SL1 (Sliding Toilet Bay Entrance Door)

1	Sliding Door Track Assembly		
2	Surface Mounted Drop Bolt Auxilliary Lock		Clear Finished Aluminum
2	Cylinders		US 26D
2	Sliding Door Pulls		US 32D
		Printed Acrylic Panel and hardware for	

mounting panel provided by allowance.

CYLINDER HARDWARE SETS.

Door Hardware Set No. : CYL 1 (Cylinder for hardware in other specification sections)

1	Cylinder		US 26D

SWING GATE HARDWARE SETS.

Door Hardware Set No.: SG 1

2	Hinge	Manufacturer's Standard Assembly	Match Gate
2	Pull	Manufacturer's Standard Assembly	Match Gate
2	Bolt	Manufacturer's Standard Assembly	

Door Hardware Set No.: SG 2

2	Hinge	Manufacturer's Standard Assembly	Match Gate
2	Pull	Manufacturer's Standard Assembly	Match Gate
2	Surface Mounted Drop Bolt Auxilliary Lock	Mount to gate with through bolts	Clear Finished Aluminum

END OF SECTION 087100

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SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thin-set, epoxy-resin terrazzo flooring.
2. Precast epoxy-resin terrazzo units.
3. Precast epoxy-resin benches.
4. *Terrazzo graphics, potentially incorporated into terrazzo floor, bid as unit prices.*

B. Related Requirements:

1. Section 012200 “Unit Prices”
2. Section 079200 "Joint Sealants" for sealants installed with terrazzo.

~~*1.3 ALLOWANCES*~~

~~*A. Work in this section is part of listed Allowance.*~~

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to terrazzo including, but not limited to, the following:

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Review special terrazzo designs and patterns.
d. Verify joint and divider strip locations with field conditions.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:

1. Divider strips.
2. Control-joint/expansion-joint strips.
3. Accessory strips.
4. Abrasive strips.
5. Precast terrazzo jointing and edge configurations.
6. Terrazzo patterns.
7. Precast terrazzo base sizes and configurations.
8. Precast terrazzo bench assembly, including sections, dimensions, and supporting substructure.

C. Samples for Initial Selection: Review design intent with Architect and Owner prior to preparation of samples of potential terrazzo colors and patterns. ~~*NTMA's "Terrazzo Color Palette" will be used as reference for colors and patterns available for each terrazzo type.*~~

1. Provide multiple samples for up to two colors for terrazzo floor and one color for precast terrazzo benches.

D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:

1. Terrazzo: 6-inch- (150-mm-) square Samples.
2. Precast Terrazzo: 6-inch- (150-mm-) square Samples.
3. Accessories: 6-inch- (150-mm-) long Samples of each exposed strip item required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each type of terrazzo material or product.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

D. Preinstallation moisture-testing reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for terrazzo including accessories.

a. Size: Minimum 100 sq. ft. (9 sq. m) of typical poured-in-place flooring and base condition for each color and pattern in locations directed by Architect.
b. Include base.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary terrazzo materials 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.

B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 EPOXY-RESIN TERRAZZO

A. Epoxy-Resin Terrazzo: Comply with manufacturer's written instructions for matrix and aggregate proportions and mixing.

B. *Mix Color and Pattern: Provide two mixes based upon final aggregate and resin colors selected by Architect and Owner through the sample preparation process. Terrazzo aggregate and resin types to be of quality and cost represented by NTMA's "Terrazzo Color Palette" Epoxy Series 4 but is not an exact copy of the preselected aggregate and resin colors*.

1. Aggregates for terrazzo floor and precast base to consist of the following.

a. 50% domestic marble.
b. 50% glass / mother of pearl.

2. Aggregates for Seal of the State of Indiana to be 14 variations of 100% glass and resin.
3. Aggregates for the Indianapolis Motor Speedway logo to be 7 variations of 100% glass and resin.

C. Materials:

1. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
2. Substrate-Crack-Suppression Membrane: Product of terrazzo-resin manufacturer, having minimum 120 percent elongation potential according to ASTM D412.

a. Reinforcement: Fiberglass scrim.

3. Primer: Manufacturer's product recommended for substrate and use indicated.
4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.

a. Physical Properties without Aggregates:

1) Hardness: 60 to 85 per ASTM D2240, Shore D.
2) Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D638 for a 2-inch (51-mm) specimen made using a "C" die per ASTM D412.
3) Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D695, Specimen B cylinder.
4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D1308.

a) Distilled water.
b) Mineral water.
c) Isopropanol.
d) Ethanol.

e) 0.025 percent detergent solution.
f) 1.0 percent soap solution.
g) 5 percent acetic acid.
h) 10 percent sodium hydroxide.
i) 10 percent hydrochloric acid.
j) 30 percent sulfuric acid.

b. Physical Properties with Aggregates: For terrazzo blended according to manufacturer's recommendations with one part epoxy resin with three parts marble aggregate consisting of 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a 1/4-inch (6.35-mm) nominal thickness, and cured for 7 days at 75 deg F (24 deg C) plus or minus 2 deg F (1 deg C) and at 50 percent plus or minus 2 percent relative humidity.

1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch (6.35 mm) according to ASTM D635.
2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C) according to ASTM C531.

5. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.

a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
b. 24-Hour Absorption Rate: Less than 0.75 percent.
c. Dust Content: Less than 1.0 percent by weight.

6. Finishing Grout: Resin based.

2.4 PRECAST EPOXY-RESIN TERRAZZO

A. Precast Terrazzo Base: Minimum 3/8-inch- (10-mm-) thick, epoxy terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm). Comply with manufacturer's written instructions for fabricating precast terrazzo base units in sizes and profiles indicated.

1. Type: Provide sizes and configurations as indicated in Drawings. *Multiple heights and edge conditions are required.*
2. Top Edge: Slightly beveled with polished top surface.
3. Outside Corner Units: With finished returned edges at outside corner.
4. Color, Pattern, and Finish: Final selection to be made with approval of floor color sample. Design intent is to match color, pattern and finish of adjacent poured-in-place terrazzo flooring.

B. Precast Terrazzo Benches: Minimum 1-inch (24-mm) thick, epoxy terrazzo assembly over supporting steel frame. *Final terrazzo thickness and design of steel frame determined by Contractor and approved by Architect.* Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to 1/8-inch (3.2-mm) radius.

1. Color, Pattern, and Finish: Final selection to be made with approval of floor color sample. Design intent is to contrast with color, pattern and finish of adjacent poured-in-place terrazzo flooring.

2.5 STRIP MATERIALS

A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.

1. Material: White-zinc alloy or aluminum as determined with selected floor color.
2. Top Width: 1/8 inch (3.2 mm) typical. Wider dimension strips may be incorporated into select areas of final design.

B. Control-Joint Strips: Separate, double L-type angles, positioned back-to-back, that match material and color of divider strips, in depth required for topping thickness indicated, separated by a 1/4 inch wide strip of semi-rigid epoxy joint filler of color to match matrix of adjacent terrazzo.

C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Edge-bead strips for exposed edges of terrazzo.

2.6 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.

B. Anchoring Devices:

1. Precast Terrazzo Base: Provide mechanical anchoring devices or adhesives for base materials as recommended by manufacturer and as required for secure attachment to substrate.
2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by sealer manufacturer.

1. Surface Friction: Not less than 0.6 according to ASTM D2047.
2. Acid-Base Properties: With pH factor between 7 and 10.
3. Products:

a. Restrooms: Provide two coats system.

1) Primer: Polysiloxane primer.
2) Topcoat: Scratch resistant, ultra-high solids urethane with ultra-fine aluminum oxide additive.

b. Polished Terrazzo: (Substitutions not permitted)

1) Crystalizing Fluid: Hertron Prime Grind 2 crystalizing fluid.
2) Seal Coat: Provide Hertron, Hertro-Seal, applied per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.
c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

D. Preinstallation Moisture Testing:

1. Testing Agency: Engage a qualified testing agency to perform tests.
2. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Moisture-Vapor-Emission Test: Maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours when tested according to ASTM F1869 using anhydrous calcium chloride.
b. Relative Humidity Test: Maximum 75 percent relative humidity measurement when tested according to ASTM F2170 using in-situ probes.

3. Proceed with terrazzo installation only after concrete substrates pass moisture testing or after installation of moisture-vapor-emission-control membrane on substrate areas that fail testing.

E. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.
1. Install concrete substrates that fail preinstallation moisture testing.

F. Substrate-Crack-Suppression Membrane: Install to isolate and suppress substrate cracks according to manufacturer's written instructions.

1. Prepare and prefill substrate cracks with rigid epoxy and sand mix.
2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
3. Reinforce membrane with fiberglass scrim.

G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Strip Materials:

1. Divider and Control-Joint Strips:

a. Locate divider strips and control-joint in locations indicated in final approved shop drawings.
b. Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
c. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install as required to provide a complete installation and in locations indicated.

C. Apply primer to terrazzo substrates according to manufacturer's written instructions.

D. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions.

1. Installed Thickness: 3/8 inch (9.5 mm) nominal.
2. Terrazzo Finishing: Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

a. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond abrasives. Follow initial grind with 60/80-grit stones or with comparable diamond abrasives.

b. Grouting: Before grouting, clean terrazzo with water, rinse, and allow to dry. Apply and cure epoxy grout. Provide pinhole free surface.

c. Fine Grinding/Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Wet polish terrazzo with 100 grit diamond abrasives until grout is removed. Follow with 200 grit wet polish until 100 grit scratches are removed.

1) Restrooms: Following completion of 200 grit polishing, complete the following. Presence of pin holes in the terrazzo will cause sealer installation to be rejected due to impact upon quality of finish.

a) Apply thin coat of specified polysiloxane clear primer and allow to cure.
b) Buff primer coat to matte finish and vacuum floor to be free of lint, dust and fines prior to application of top coat.
c) Apply specified top coat with additives.

2) Polished Terrazzo: Following completion of 200 grit polishing, complete the following.

a) Continue wet polish with successive grits of 400, 800, 1500. Completely remove scratches of previous grit prior to proceeding to next finer grit.
b) Continue wet polish with 3000, then 8000 grit using Hertron Prime Grind 2 crystalizing fluid.
c) Seal floor with Hertron Herto-Seal penetrating sealer.
d) Buff floor to remove excess sealer from finished surface.

3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/8 inch in 10 feet ; noncumulative.

3.4 PRECAST TERRAZZO INSTALLATION

A. Install precast terrazzo units using method recommended in writing by NTMA and manufacturer unless otherwise indicated.

B. Do not install units that are chipped, cracked, discolored, or improperly finished.

C. Seal joints between units in same plane with joint compound matching precast terrazzo matrix. Seal joints between units at inside corners with joint sealant.

3.5 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.6 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.
2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

1. Protect floor with masonite floor protection panels and fully taped seams.

END OF SECTION 096623