

SECTION 033543 - SEALED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid floor treatments.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for new concrete designed for sealed concrete finishing, including concrete materials, mixture design, placement procedures, initial finishing, and curing.

1.2 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of sealed concrete.
- B. Specular Gloss: A reflectance value determined by a single measurement of gloss from shining a known amount of light at a surface within a specific angle of illumination in accordance with ASTM D523.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with sealed concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Cast-in-place concrete subcontractor.
 - c. Concrete finishing subcontractor.
 - d. Architect.
 - e. Owner's representative.
2. Review concrete slab design for compressive strength, flatness and levelness, construction joints, concrete finishing, concrete appearance and aggregate exposure requirements, concrete mockups, and protection of sealed concrete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Laboratory Test Reports: For liquid floor treatments, indicating compliance with requirements for low-emitting materials.

1.5 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location of the Work and of the size indicated as directed by Architect for newly placed concrete.
 - 2. Demonstrate surface preparation, sealing and protecting of concrete.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as needed for other construction activities.
- B. Ambient Conditions: Ensure installation location and Project ambient conditions comply with manufacturers written instructions.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

- A. VOC Content: For field applications, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Primers, Sealers, and Undercoaters: 100 g/L.
 - 2. Low-Emitting Materials: Verify VOC emissions comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.2 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Sealed Concrete Finish: Clear liquid materials for the applications of cleaning solutions, densifiers, and sealers that strengthen or protect concrete surfaces. Apply to all floors not receiving resinous coating.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams; Cemlack concrete sealer or comparable product by one of the following:
 - a. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
 - b. Laticrete International, Inc.

2.3 ACCESSORIES

- A. Repair Materials: As recommended in writing by manufacturer to repair and fill cracks, and repair surfaces compatible with sealer materials.
- B. Water: Potable.
- C. Cleaning Agents: As recommended in writing by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that concrete substrates are acceptable for grinding and product installation as recommended by manufacturer.
- B. Do not begin Work until unsatisfactory conditions have been addressed and corrected.

3.2 PREPARATION

- A. Verify that concrete substrate preparation is in accordance with manufacturer's written instructions.
- B. Clean surfaces free of dust, dirt and other contaminants incompatible with liquids applied products and sealer.
- C. Clean and seal cracks as recommended by manufacturer.
- D. Prepare, clean and fill joints with joint filler as recommended in writing by manufacturer.
- E. Clean surface completely of any dust with cleaning solution as recommended in writing by manufacturer.

3.3 APPLICATION

- A. Apply sealers to concrete and in accordance with manufacturers' written instructions.
- B. Complete edges of floor finish that adjoins surrounding floor areas in a sharp and clean manner.
- C. Neutralize and clean floor surfaces.

3.4 FIELD QUALITY CONTROL

- A. Architect or Owner representative visually verify the sealer application is without defect.

3.5 CLEANING AND PROTECTION

- A. Protect installed sealed concrete surfaces from damage during construction in accordance with manufacturer's written instructions.

END OF SECTION 033543

SECTION 087100 - DOOR HARDWARE – REV 1

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
4. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, including cylinders.

1.02 REFERENCES

A. UL LLC

1. UL 1784 - Air Leakage Tests of Door Assemblies
2. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
2. NFPA 101 – Life Safety Code

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities

2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
4. Key Schedule:
 - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.

- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
 - a. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Required egress door assemblies, in compliance with Virginia Construction Code (VCC).

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.

3. Architectural Hardware Consultant: 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 meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Pre-Installation Meetings

1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Address for delivery of keys.
2. Pre-installation Conference
 - 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. Review required testing, inspecting, and certifying procedures.
 - d. Review questions or concerns related to proper installation and adjustment of door hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop 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.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage ND Series: 10 years
 - b) Falcon: 10 years
 - 2) Exit Devices
 - a) Falcon: 10 years
 - 3) Closers
 - a) Falcon SC Series: 10 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Hollow Metal Doors and Frames" and "Aluminum-Framed Entrances and Storefronts" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Select
 - b. Roton

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds and successfully tested for 1,500,000 cycles.
5. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.04 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
2. Acceptable Manufacturers and Products:
 - a. Sargent 11-Line
 - b. Corbin-Russwin CL3100 series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1.
2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
3. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: SPA.

2.05 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon T series
2. Acceptable Manufacturers and Products:
 - a. Best 9K series
 - b. Schlage ND series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: QUA.

2.06 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon 24/25 series
2. Acceptable Manufacturers and Products:
 - a. Detex Advantex
 - b. Von Duprin 78/75 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
11. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
12. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.07 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer:
 - a. Falcon

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Open: cylinder with small format interchangeable core (SFIC) core with open keyway

2.08 KEYING

A. Scheduled System:

1. New factory registered system:

- a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys
 - b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.09 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Telkee
2. Acceptable Manufacturers:
 - a. HPC
 - b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.10 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon SC70A series
2. Acceptable Manufacturers and Products:
 - a. LCN 4050 series
 - b. Sargent 351 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
2. Acceptable Manufacturers:
 - a. Rixson
 - b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.12 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.13 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Zero International
2. Acceptable Manufacturers:
 - a. National Guard
 - b. Pemko

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.14 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

- a. Ives
- 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco
- B. Requirements:
 - 1. Provide "push-in" type silencers for hollow metal or wood frames.
 - 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
 - 3. Omit where gasketing is specified.

2.15 FINISHES

- A. FINISH: BHMA 626/652 (US26D); EXCEPT:
 - 1. Hinges at Exterior Doors: BHMA 630 (US32D)
 - 2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
 - 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 - 4. Protection Plates: BHMA 630 (US32D)
 - 5. Overhead Stops and Holders: BHMA 630 (US32D)
 - 6. Door Closers: Powder Coat to Match
 - 7. Wall Stops: BHMA 630 (US32D)
 - 8. Latch Protectors: BHMA 630 (US32D)
 - 9. Weatherstripping: Clear Anodized Aluminum
 - 10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. 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.
 - 2. Installation Guide for Doors and Hardware: DHI TDH-007-20

- B. Install door hardware in accordance with VCC 2021 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Furnish permanent cores to Owner for installation.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- L. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- M. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 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. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Hardware Group No. EXT-01

For use on Door #(s):

100

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	STOREROOM LOCK	T581B QUA		626	FAL
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A HDPA		689	FAL
1	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	8655A		A	ZER

Hardware Group No. EXT-02

For use on Door #(s):

101

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	STOREROOM LOCK	T581B QUA		626	FAL
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA		689	FAL
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	8655A		A	ZER

Hardware Group No. EXT-03

For use on Door #(s):

103

105

107

109

111

113

115

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	ENTRANCE LOCK W/ OUTSIDE INDICATOR	ND55BD SPA OS-OCC		626	SCH
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA		689	FAL
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	8655A		A	ZER

Hardware Group No. EXT-04

For use on Door #(s):
108

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	24-R-L-NL-QUA		626	FAL
1	EA	MORTISE CYLINDER	C987		626	FAL
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A HDPA		689	FAL
1	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	GASKETING BY ALUMINUM DOOR SUPPLIER			B/O
1	EA	THRESHOLD	8655A		A	ZER

Hardware Group No. EXT-05

For use on Door #(s):
112

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	STOREROOM LOCK	T581B QUA		626	FAL
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A SS		689	FAL
1	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	8655A		A	ZER

Hardware Group No. EXT-06

For use on Door #(s):
117B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	CLASSROOM LOCK	T561B QUA		626	FAL
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A SS		689	FAL
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	8655A		A	ZER

Hardware Group No. INT-01

For use on Door #(s):
102 104

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	ENTRY / OFFICE LOCK	T521B QUA		626	FAL
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA		689	FAL
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. INT-02

For use on Door #(s):
104A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PASSAGE SET	T101 QUA		626	FAL
1	EA	OH STOP & HOLDER	90H		652	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. INT-03

For use on Door #(s):
104B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PASSAGE SET	T101 QUA		626	FAL
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. INT-04

For use on Door #(s):
106

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	ENTRANCE LOCK W/ OUTSIDE INDICATOR	ND55BD SPA OS-OCC		626	SCH
1	EA	SFIC CORE	C606		626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA		689	FAL
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. INT-05

For use on Door #(s):
110 110A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	CLASSROOM LOCK	T561B QUA		626	FAL
1	EA	SFIC CORE	C606		626	FAL
1	EA	OH STOP & HOLDER	90H		652	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. RU-1

For use on Door #(s):
117A 119

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
	EA	Note	All Hardware By Roll-Up Door Manufacturer			

WILEY|WILSON

CITY OF STAUNTON
GYPSY HILL PARK POOL HOUSE
COMM. NO.: 240163.00

END OF SECTION

SECTION 271000 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS GENERAL

1.1 SUMMARY

A. Section Includes:

1. Communications-circuit accessories.

B. Products Installed, but Not Furnished, under This Section:

1. Section 061000 "Rough Carpentry" furnishes equipment backing panels installed by this Section.
 2. Section 260526 "Grounding and Bonding for Electrical Systems" furnishes the following installed by this Section:
 - a. Grounding and bonding conductors.
 - b. Grounding and bonding clamps.
 - c. Grounding and bonding bushings.
 - d. Grounding and bonding hubs.
 - e. Grounding and bonding connectors.
 - f. Intersystem bonding bridge grounding connector.
 - g. Grounding and bonding busbars.
 - h. Signal reference grids.
 3. Section 260529 "Hangers and Supports for Electrical Systems" furnishes hangers, supports, and concrete bases for communications equipment installed by this Section.
 4. Section 260533.16 "Boxes and Covers for Electrical Systems" furnishes the following installed by this Section:
 - a. Metallic outlet boxes, device boxes, rings, and covers.
 - b. Junction boxes and pull boxes.
 - c. Cover plates for device boxes.
 5. Section 260553 "Identification for Electrical Systems" furnishes labels and warning signs for communications pathways installed by this Section.
 6. Section 262726 "Wiring Devices" furnishes duplex receptacles installed by this Section.
- C. Related Requirements:
1. Section 013100 "Project Management and Coordination for preinstallation conference procedures.

1.2 DEFINITIONS

A. Abbreviations for Communications Spaces:

1. EF: Entrance facility; generally, serves campus or building. EF may include an ER.
2. ER: Equipment room; generally, serves campus or building.
3. TE: Telecommunications enclosure; generally, serves a single tenant or floor.
4. TR: Telecommunications room; generally, serves a single tenant or floor.

B. Abbreviations for Communications Facilities:

1. HC: Horizontal cross-connect; also called "floor distributor" (FD).
2. IC: Intermediate cross-connect; also called "building distributor" (BD).
3. MC: Main cross-connect; also called "campus distributor" (CD).

C. Abbreviations for Grounding and Bonding:

1. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.
2. PBB: Primary bonding busbar; located in main distribution frame room, ideally near electrical service entrance.
3. RBB: Rack bonding busbar; located in equipment cabinets and racks.
4. SBB: Secondary bonding busbar; located in intermediate distribution frame rooms.
5. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.
6. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.
7. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.
8. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Communications equipment room drawings, diagrams, and supporting documents.

PART 2 - PRODUCTS

2.1 COMMUNICATIONS-CIRCUIT ACCESSORIES

- A. Description: This category covers devices intended for connecting communications circuits in accordance with Article 800 of NFPA 70.

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria:

- a. For Communications Circuits: UL CCN DUXR; including UL 1863 and UL 467.
 - b. For Audio/Video, Data, and Signaling Circuits: UL CCN DUXR; including UL 1977 and UL 467.
- C. UL DUXR - 66-Style or 110-Style Cross-Connect Frame:
- 1. Source Limitations: Obtain products from single manufacturer.
 - 2. Description: This product type includes the frame only. Block inserts and related termination equipment are specified in communications cabling Sections.
- D. UL DUXR - Patch Panel:
- 1. Source Limitations: Obtain products from single manufacturer.
 - 2. Product Characteristics:
 - a. Mounting: Equipment rack.
 - b. Style: Modular.
 - c. EMI Compatibility: Unshielded.
 - d. Configuration: Standard.
 - e. Include provisions for labeling ports.
 - 3. Required Product Options:
 - a. Distribution Port Quantity: 24.
 - b. Cable Type: Cat. 6.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Shop Drawings: Prepare and submit the following:
- 1. Communications Equipment Room Drawings, Diagrams, and Supporting Documents:
 - a. Include plans, elevations, sections, details, and attachments to other work.
 - b. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Equipment Racks and Cabinets: Indicate workspace requirements and access for cable connections.
 - d. Switchboards, Panelboards, and Safety Switches: Indicate workspace requirements and access for cable connections.
 - e. Grounding and Bonding: Indicate location of busbars and their mounting details showing standoff insulators and wall mounting brackets.
 - f. Cable Trays, Large Raceways, Ducts, and Piping: Indicate elevation and route of vertical and horizontal cable trays, raceways or ducts larger than **2 inch (50 mm)** wide, and fire-suppression piping located inside communications equipment room.
 - g. Luminaires: Indicate elevation, orientation, and size of luminaires inside the communications equipment room for coordination with cable trays, equipment racks, cabinets, and other equipment.

- h. Access Panels: Indicate locations, dimensions, and clearances required to open access panels in ducts, walls, or ceilings inside communications equipment room.
 - i. Controls: Indicate locations of sensors, switches, and push-buttons for HVAC, fire suppression, fire alarm, and standby power.
 - j. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
 - k. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.
 - l. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
- B. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

3.2 SELECTION OF GROUNDING AND BONDING PRODUCTS FOR COMMUNICATIONS

A. Grounding and Bonding Conductors:

1. Communications Busbar Connections:

- a. TBC: Not smaller than 1/0 AWG and no smaller than largest TBB.
- b. TBB: Not smaller than 2 kcmil per linear ft of conductor length, but not larger than 750 kcmil, unless otherwise indicated on Drawings.
- c. BBC: Not smaller than largest TBB to which it is connected unless otherwise indicated on Drawings.
- d. TEBC: Not smaller than 2 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
- e. UBC: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
- f. Bonding Conductors to Structural Steel: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted clamp connectors.

B. Grounding and Bonding Busbars:

1. PBB (TMGB):

- a. Dimensions: 1/4 inch thick by 4 inch high (6.3 mm thick by 100 mm high).
- b. Stand-Off Distance: 2 inch (50 mm).

3.3 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:

- 1. Fire-protection equipment must be finished, painted, or suitably marked safety red.
- 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft (2.3 m) above finished floor.

- B. Pipe and Conduit Labeling: Comply with ASME A13..
- C. Color Coding Scheme for Communications Cable and Terminations: Comply with BICSI N1 and TIA-598.
- D. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
 - 1. "COMMUNICATIONS."
 - 2. "FIRE ALARM."
 - 3. "SECURITY."
- E. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- F. Locations of Underground Lines: Underground-line warning tape for communication, control wiring, and optical-fiber cable.
- G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.
- H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with conductor designation.
- I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
- J. Equipment and Cabling Identification for Administrative Records and Labeling: Comply with TIA-606 requirements for Class 2 network administration.
- K. Equipment Identification Labels:
 - 1. Black letters on white field.
 - 2. Indoor Equipment: Self-adhesive label.
 - 3. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 4. Equipment to Be Labeled:
 - a. Racks, Frames, and Enclosures: Identify front and rear of each enclosure with self-adhesive labels.
 - b. Patch Panels: Label individual rows and outlets, starting at top left and working down, with self-adhesive labels.
 - c. Communications cabinets.
 - d. Access doors and panels for concealed communications items.
 - e. Emergency system boxes and enclosures.
 - f. Contactors.
 - g. Remote-controlled switches, dimmer modules, and control devices.
 - h. Monitoring and control equipment.
 - i. Fire-alarm equipment.
 - j. Security equipment.

- k. Life-safety communications equipment.
 - L. Horizontal Cables: Label each cable with a self-adhesive wraparound label.
 - M. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Identify cover plate in accordance with TIA-606.
 - N. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- 3.4 SELECTION OF SIGNS AND HAZARD MARKINGS
- A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.
 - B. Signs, labels, and tags required for personnel safety must comply with the following standards:
 - 1. Safety Colors: NEMA Z535.1.
 - 2. Facility Safety Signs: NEMA Z535.2.
 - 3. Safety Symbols: NEMA Z535.3.
 - 4. Product Safety Signs and Labels: NEMA Z535.4.
 - 5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.
 - C. Electrical Hazard Warnings:
 - 1. Multiple Power Sources Warning Legend: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT/RACK HAS MULTIPLE POWER SOURCES."
 - D. Operating Instruction Signs: Self-adhesive labels.
 - E. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"
- 3.5 FIELD-FABRICATION OF FITTINGS FOR ENTRANCE FACILITY/ EQUIPMENT ROOM
- A. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Communications Systems: Comply with Ch. 8 of NFPA 70 and with BICSI N1.
 - 2. Grounding and Bonding: Comply with Article 250 of NFPA 70 and with BICSI N3.
 - 3. Consult Architect for resolution of conflicting requirements.
 - B. Provide the following specified products in entrance facility room or space:
 - 1. One equipment backing panel.
 - a. Install from 6 inch (150 mm) to 8 ft, 6 inch (2588 mm) above finished floor. If plywood is fire treated, ensure that fire-treatment stamp is visible after installation.

2. One PBB.
3. One extra-heavy-duty, NEMA 5-20R duplex straight-blade receptacle, outlet box, and cover plate.
4. One 19 inch enclosed equipment rack with RBB and enclosure-mounted relocatable power tap.
5. One 110-style cross-connect frame.
6. One patch panel.

3.6 INSTALLATION OF BONDING FOR COMMUNICATIONS

- A. Grounding of Communications: Bond PBB and SBBs to grounding electrode conductors at electrical power service entrance, and at electrical power derived systems serving communications equipment, using intersystem bonding termination device.
 1. Structural Steel: Where structural steel of steel frame building is readily accessible within room or space, bond each SBB and PBB to vertical steel of building frame.
- B. Comply with manufacturer's published instructions.
- C. Reference Standards:
 1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
 2. Consult Architect for resolution of conflicting requirements.
- D. Special Techniques:
 1. Bonding of Busbars:
 - a. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 12 inch (300 mm) above finished floor unless otherwise indicated.
 - b. Where busbars are indicated on both sides of doorways, route bonding conductor up to top of door frame, across top of doorway, and down; connect to continuation of horizontal busbar.
 2. Bonding Conductors:
 - a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
 - b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:
 - 1) Use crimping tool and die specific to connector.
 - 2) Pretwist conductor.
 - 3) Apply antioxidant compound to bolted and compression connections.

- c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
 - d. Install without splices.
 - e. Support conductors at not more than 36-inch (900 mm) intervals.
 - f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.
 - 1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing and bond both ends of raceway to SBB.
- 3. Provide TBC and terminate ends to PBB and intersystem bonding busbar at electrical service entrance in accordance with Section 250.94, "Bonding for Communication Systems," of NFPA 70.
 - 4. Busbar Interconnections: Bond SBBs to PBB with TBBs. If more than one TBB is installed, bond TBBs together with BBCs where required by TIA-607.
 - 5. Communications Enclosures: Bond metallic enclosures of telecommunications equipment with UBCs to nearest SBB or PBB.
 - 6. Equipment Racks: Bond metallic components of enclosures to RBB using UBCs. Provide top-mounted RBB if not provided by enclosure or rack manufacturer. Bond RBB to SBB with TEBC. Power connection must comply with NFPA 70; equipment grounding conductor in power cord of cord- and plug-connected equipment must be considered supplemental to bonding requirements in this Section.
 - 7. Primary Protector: Bond to PBB with insulated bonding conductor.
 - 8. Electrical Power Panelboards: Where electrical panelboards for communications equipment are located in same room or space, bond each ground bar of panelboard to SBB.

3.7 FIELD QUALITY CONTROL FOR BONDING OF COMMUNICATIONS

- A. Field tests and inspections must be witnessed by Tenant.
- B. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.
 - 2. Test bonding connections of system using AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.
 - a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 mΩ.

- 1) If measured resistance from electrical service equipment to ground exceeds $5\ \Omega$, notify Architect and include recommendations to reduce resistance to ground.
 - b. Measure resistance between SBBs and PBB. Maximum acceptable value is $100\ \text{m}\Omega$.
 3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.
 - a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB. Maximum acceptable AC current level is 1 A.
- C. Nonconforming Work:
1. Communications bonding will be considered defective if it does not pass tests and inspections.
 2. Remove and replace defective units and retest.
- D. Collect, assemble, and submit test and inspection reports.

3.8 PROTECTION

- A. After installation, protect communications equipment room fittings from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 271100

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Category 6 twisted pair cable.
2. Twisted pair cable hardware.
3. Cable management system.
4. Identification products.

B. Related Requirements:

1. Section 270513 "Conductors and Cables for Communications Systems" for data cabling associated with system panels and devices.

1.2 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- H. LAN: Local area network.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP: Overall braid screened cable with foil screened twisted pair.

- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

1.3 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
 - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m) and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Category 6 twisted pair cable.
 - 2. Twisted pair cable hardware.
 - 3. Cable management system.
 - 4. Identification products.
- B. Shop Drawings: Reviewed and stamped by RCDD.
 - 1. System Labeling Schedules:
 - a. Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. Cabling administration Drawings and printouts.
 - 3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
 - a. Telecommunications rooms plans and elevations.
 - b. Telecommunications pathways.
 - c. Telecommunications system access points.
 - d. Telecommunications grounding system.
 - e. Telecommunications conductor drop locations.

- f. Typical telecommunications details.
- g. Mechanical, electrical, and plumbing systems.

C. Twisted pair cable testing plan.

D. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [RCDD,][Installer,]installation supervisor, and field inspector.

B. Source quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

- 1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field-testing program development by an RCDD.
- 2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

- 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

- 1. Test each pair of twisted pair cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
 - 1. Communications, Non-Plenum Rated:
 - a. Type CMR complying with UL 1666 and ICEA S-103-701.
 - b. Type CMP or Type CMR in listed plenum or riser communications raceway.
 - c. Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: **25** or less.
 - 2. Smoke-Developed Index: **50** or less.
- C. RoHS compliant.

2.3 CATEGORY 6 TWISTED PAIR CABLE

- A. Category 6 Twisted Pair Cable: Four-pair, balanced -twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.
- B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- C. Conductors: 100-ohm, 23 AWG solid copper.
- D. Cable Rating: **Riser**.

- E. Jacket: **Blue** thermoplastic.

2.4 TWISTED PAIR CABLE HARDWARE

- A. Twisted Pair Cable Hardware: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. General Requirements for Twisted Pair Cable Hardware:
1. Comply with the performance requirements of Category 6.
 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks:
1. 110-style IDC for Category 6.
 2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
1. Features:
 - a. Universal T568A and T568B wiring labels.
 - b. Labeling areas adjacent to conductors.
 - c. Replaceable connectors.
 - d. 24 or 48 ports.
 2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
 3. Number of Jacks per Field: One for each four-pair cable indicated.
- F. Patch Cords: Factory-made, four-pair cables in 36-inch (900-mm) lengths; terminated with an eight-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
- G. Plugs and Plug Assemblies:
1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
 2. Standard: Comply with TIA-568-C.2.
 3. Marked to indicate transmission performance.

H. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or cover plate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

I. Cover Plate:

1. Four port, vertical single gang cover plates designed to mount to single gang wall boxes.
2. Plastic Cover Plate: High-impact plastic. Coordinate color with Section 260533.16 "Boxes and Covers for Electrical Systems."
3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

J. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 CABLE MANAGEMENT SYSTEM

- A. Cable Management System: Computer-based cable management system, with integrated database capabilities.
- B. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.
- C. Information shall be presented in database view, schematic plans, or technical drawings.
- D. System shall interface with the following testing and recording devices:
 1. Direct upload tests from circuit testing instrument into the personal computer.
 2. Direct download circuit labeling into labeling printer.

2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 SOURCE QUALITY CONTROL

- A. Factory test cables on reels according to TIA-568-C.1.
- B. Factory test twisted pair cables according to TIA-568-C.2.

- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Routing:
 - 1. Install cables in raceways, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.
 - a. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
 - 2. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

- A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."
- B. Comply with Section 270528 "Pathways for Communications Systems."
- C. Comply with Section 260529 "Hangers and Supports for Electrical Systems."
- D. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
 - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
 8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
 9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 11. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 12. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Group connecting hardware for cables into separate logical fields.
- D. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- C. Comply with TIA-607-B and NECA/BICSI-607.
- D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: Class 2.
 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
 - b. Label each unit and field within distribution racks and frames.
 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Tenant.
- B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- D. Nonconforming Work:
1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. Collect, assemble, and submit test and inspection reports.
- F. Manufacturer Services:
1. Engage factory-authorized service representative to support field tests and inspections.

END OF SECTION 271513

SECTION 275116 - PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Battery backup power unit.
2. Preamplifiers.
3. Power amplifiers.
4. Transfer to standby amplifier.
5. Microphones.
6. Volume limiter/compressor.
7. Control console.
8. Equipment cabinet.
9. Equipment rack.
10. Telephone paging adapter.
11. Tone generator.
12. Monitor panel.
13. Loudspeakers.
14. Noise-operated gain controller.
15. Conductors and cables.

1.3 DEFINITIONS

- A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.
- B. VU: Volume unit.
- C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Power, signal, and control wiring.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
3. Console layouts.
4. Control panels.
5. Rack arrangements.
6. Calculations: For sizing backup battery.
7. Wiring Diagrams: For power, signal, and control wiring.
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For Installer.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For public address systems to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 017700 "Closeout Procedures" and Section 017839 "Project Record Documents," include the following:
 - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - b. Operating instructions laminated and mounted adjacent to operating console location.
 - c. Training plan.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Microphone: Two.
 2. Microphone Desk Stand(s): Two.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 - 1. Personnel certified by NICET as Audio Systems Level II Technician.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain public address system from single source from single manufacturer.
- B. 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.
- C. Comply with NFPA 70.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. System Functions:
 - 1. Selectively control sound from microphone outlets and other inputs.
 - 2. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
 - 3. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
 - 4. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 - 5. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.3 SYSTEM DESCRIPTION

- A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch (483-mm) housing complying with EIA/ECA-310-E.
- D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.4 PREAMPLIFIERS

- A. Preamplifier:
 - 1. Separately mounted.
 - 2. Integral to power amplifier.
- B. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.
- C. Total Harmonic Distortion: Less than 1 percent.
- D. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
- E. Input Jacks: Minimum of three. One matched for low-impedance microphone; one USB port; and the other matchable to DVD or CD player, or radio tuner signals without external adapters.
- F. Minimum Noise Level: Minus 55 dB below rated output.
- G. Controls: On-off, input levels, and master gain.

2.5 POWER AMPLIFIERS

- A. Mounting: Rack. Power amplifiers are existing and intended to be reused. Install them in the Telecom rack if possible.

2.6 MICROPHONES

- A. Paging Microphone:
 - 1. Type: Dynamic, with omnidirectional polar characteristic.
 - 2. Impedance: 500 ohms.
 - 3. Frequency Response: Uniform, 50 to 15,000 Hz.
 - 4. Sensitivity: Minus 70 dB.
 - 5. Output Level: Minus 58 dB, minimum.
 - 6. Cable: Braided shield cable with Amphenol XLR connectors. Coordinate impedance with microphone impedance.
 - 7. Mounting: Desk stand with integral-locking, press-to-talk switch.

2.7 CONTROL CONSOLE

- A. Cabinet: Modular, desktop; complying with EIA/ECA-310-E.
- B. Housing: Steel, 0.0478 inch (1.2 mm) minimum, with removable front and rear panels. Side panels are removable for interconnecting side-by-side mounting.
- C. Panel for Equipment and Controls: Rack mounted.
- D. Controls:

1. Switching devices to select signal sources for distribution channels.
 2. Program selector switch to select source for each program channel.
 3. Switching devices to select zones for paging.
 4. All-call selector switch.
- E. Indicators: A visual annunciation for each distribution channel to indicate source being used.
- F. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.
- G. Spare Positions: 20 percent spare zone control and annunciation positions on console.
- H. Microphone jack.

2.8 EQUIPMENT CABINET

- A. Comply with EIA/ECA-310-E.
- B. House amplifiers and auxiliary equipment at each location.
- C. Cabinet: Install Public Address system head end equipment within telecom cabinet.
- D. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.
- E. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.

2.9 TELEPHONE PAGING ADAPTER

- A. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.
1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
 2. Impedance Matching: Adapter matches telephone line to public address equipment input.
 3. Cabinet mounted.

2.10 TONE GENERATOR

- A. Tone generator shall provide clock and program interface with public address system.
- B. Signals: Minimum of seven distinct, audible signal types including wail, warble, high/low, alarm, repeating and single-stroke chimes, and tone.
- C. Pitch Control: Chimes and tone.

- D. Volume Control: All outputs.
- E. Activation-Switch Network: Establishes priority and hierarchy of output signals produced by different activation setups.
- F. Mounting: Cabinet.

2.11 MONITOR PANEL

- A. Monitor power amplifiers.
- B. Components: VU or dB meter, speaker with volume control, and multiple-position rotary selector switch.
- C. Selector Switch and Volume Control: Selective monitoring of output of each separate power amplifier via VU or dB meter and speaker.
- D. Mounting: Cabinet.

2.12 LOUDSPEAKERS

- A. Horn-Type Loudspeakers:
 - 1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
 - 2. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
 - 3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
 - 4. Dispersion Angle: 130 by 110 degrees.
 - 5. Mounting: Integral bracket.
 - 6. Units in Damp, Wet, or Outdoor Locations: Listed and labeled for environment in which they are located.
 - 7. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located. Provide any accessories required to maintain listing.

2.13 CONDUCTORS AND CABLES

- A. Jacketed, twisted pair and twisted multipair, untinned solid copper.
 - 1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 - 2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
 - 3. Plenum Cable: Listed and labeled for plenum installation.

2.14 PATHWAYS

- A. Conduit and Boxes: Comply with Section 260533.13 "Conduits for Electrical Systems." And 260533.16 "Boxes and Covers for Electrical Systems".
 - 1. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method:
 - 1. Install cables in pathways except within consoles, cabinets, desks, and counters. Conceal pathway and cables except in unfinished spaces.
 - a. Comply with requirements for pathways and boxes specified in Section 270528 "Pathways for Communications Systems."
 - 2. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems." for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Cable Installation Requirements:
 - 1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - 2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - 3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

- D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate pathways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other communication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

- A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- C. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
- D. Equipment Cabinets and Racks:
1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
 2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
- E. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

- F. Wall-Mounted Outlets: Flush mounted.
- G. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.
- H. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
- I. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
- J. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
- K. Connect wiring according to Section 271500 "Communications Horizontal Cabling" and Section 280513 "Conductors and Cables for Electronic Safety and Security."

3.5 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing public address system and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
 - 4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other

- microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
 - b. Repeat test for each separately controlled zone of loudspeakers.
 - c. Minimum acceptance ratio is 50 dB.
- 5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
 - 6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
 - 7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
 - 8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section 270526 "Grounding and Bonding for Communications Systems."
- E. Inspection: Verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
 - F. Public address system will be considered defective if it does not pass tests and inspections.
 - G. Prepare test and inspection reports.
 - 1. Include a record of final speaker-line matching transformer-tap settings and signal ground-resistance measurement certified by Installer.

3.7 STARTUP SERVICE

- A. Perform startup service.
 - 1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 - 2. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

- B. Occupancy Adjustments: 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 Project during other-than-normal occupancy hours for this purpose.

3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 275116