Facilities Design and Construction Services

Architectural and Engineering Design Standards

As of 2/24/2011

Commerce Building
34 Broad Street
Suite 1200
Atlanta, GA 30303-3083
Phone: 404/413-0800
Fax: 404/413-0785
SECTION 01000
GENERAL REQUIREMENTS

General overall layout of rooms, corridors and facilities shall provide maximum flexibility and access for routine maintenance. (Reference University ‘Design Guidelines’ notebook for standard room sizes)

1.1 Handicapped accessibility: all work shall comply with current published criteria of ADAAG (Americans with Disabilities Act Accessibility Guidelines) and applicable codes.

1.2 Restroom Doors: New restrooms to be designed with vestibule to eliminate need for doors whenever possible. Acoustical and other design considerations may make doors desirable in some applications with approval of Project Manager. When doors are used it is preferable that they should swing out of restrooms.

1.3 Provide access to building for maintenance vehicles. Provide shielded exterior areas with wash down capability for refuse containers.

1.4 Provide adequate storage areas for custodial materials as well as maintenance equipment. (The Facilities Maintenance and Operations Department typically needs a 10’ x 20’ Storage Room for a new building or multistory renovation).

1.5 Provide accessibility utility tunnels for new construction as practical. Provide (where possible) an outside door to mechanical rooms, particular boiler rooms (which require mechanics to carry chemicals for equipment services.)

1.6 Mechanical rooms should not be located next to sound sensitive spaces. Locate high voltage transformers as far from office/classroom space (including above and below) as practical.

1.7 Acoustics should be considered in appropriate areas for comfort, presentations, and privacy.

1.8 Room numbering on all design/construction documents shall be coordinated with and approved by University’s Project Manager. Establish space numbering prior to preliminary (35%) design review.

1.9 Avoid inaccessible ceiling systems (to accommodate maintenance).

1.10 Provide safe rooftop access for large, heavy loads, and from mechanical or utility spaces. Elevator access to roof is preferred. Stair access to roof is acceptable with double doors only to roof.

1.11 Provide North arrows on all floor plans. Provide Key Map/Plans to show the location of the work. Provide GSU logo at top right corner of plans.
1.12 When writing specifications for construction work which will involve use of existing elevators, require Contractor to clean elevator thresholds and sills daily and to dust off and/or vacuum off contacts weekly. This part requires an elevator mechanic. This will reduce the incidents of elevator calls due to construction debris jamming the functions of the elevator. Provide protection for the cab with 2’ x 2’ frames and masonite panels for walls, ceilings and floors. Add to project Special Conditions specification section wherever applicable: “Any requirements/requests for independent operation of existing University elevators for specialized handling must be in written request to University’s Facilities Maintenance and Operations Department and the Communication Center (404-413-0700). The University’s Communication Center will coordinate with other building users before permission for exclusive use is granted. All costs involved shall be paid by the Contractor making the requests.”

1.13 Design space layouts so that all major equipment may be removed and replaced without removal of building elements.

1.14 All access panels to concealed shafts, piping, valves, and equipment shall be 24” square minimum (18” panels not acceptable).

1.15 For any conflicts between these Standards and any Building, Mechanical, Plumbing, Gas, Fire Protection, or Electrical Codes, the Codes shall prevail.

1.16 Flooring for common areas and lobbies shall use stone, tile, quarry material or other durable material.

END OF SECTION
SECTION 02000

SITE REQUIREMENTS

1.1 GENERAL

A. Street and parking lot layouts shall comply with standards of municipality in which project is located.

B. Design drainage structures and surface runoff to remove water efficiently from the site.

C. Select traffic pavement type for specific soil conditions and anticipated loading. Use Georgia Department of Transportation standard pavement specifications. Preference for permeable pavement.

D. Soil conditions should be tested by a licensed professional geo technical engineer. Foundations shall be designed in accordance with engineer’s recommendations. Copy of soils report shall be delivered to University’s Project Manager for project file.

E. Provide bollards where there are vehicular passageways i.e. loading docks, driveways next to building. This is to protect the building, dock, utilities, or other structures that could be damaged by vehicles.

F. Use PVC for outside sewer pipe, except under street or slab, use ductile iron, concrete lined.

1.2 IRRIGATION SYSTEM (required for all landscaped areas)

A. Drip irrigation to be installed in all shrub and tree areas of the landscape, except that planter areas within street sidewalks shall not be irrigated (City of Atlanta does not permit sprinkler lines under sidewalks).

B. Fixed spray irrigation using standard 12 inches pop up sprinklers shall be installed in all annual and perennial beds.

C. Fixed spray or gear driven rotor sprinklers shall be installed in all turf areas. Type of head depends on size of area. Fixed sprays in turf areas must raise 6 inches minimum above grade.

D. All isolation valves shall be full port brass valves located inside a 10-inch valve box.

E. Install within 10 inches of the main isolation valve, a dual check backflow prevention device (use National Plumbing Code to specify specific type) inside a 12” valve box or suggested size box. Master valve shall be installed after the backflow prevention device using a normally closed valve. This master valve shall be electrically operated with a minimum of #12 UF wire, blue in color.
F. Flow meter shall be installed after the master valve using the manufacturer’s recommendations. The type of flow meter shall be determined by the designer. Flow meter must have the capability to communicate with the Maxicom Central Control System.

G. Brass quick connects shall be placed around the property allowing for easy access to water.

H. All electric valves shall be installed in a 10-inch valve box.

I. Communication wire must meet all Maxicom specifications.

J. Controller must have the ability to communicate with the Maxicom Cluster Control Unit.

K. Drip irrigation shall be staked and stable ground every 4 feet.

L. All wire connectors must include a wire nut enclosed inside a waterproof gel.

M. Any above ground irrigation lines must be installed using Schedule 40 PVC.

N. Any irrigation design must be completed by a certified irrigation designer.

O. Any Maximum hardware must be installed by a certified installer.

P. Any critical inspection of pipes will include camera investigation as directed by project manager.

END OF SECTION
SECTION 03000

CONCRETE

1.1 Structural Concrete:

A. The Board of Regents Building Project Procedure Manual requires that new construction conform to State building Code Type I or II. Our best experience has been with concrete structures. While Georgia State University favors structural work in reinforced concrete as opposed to steel, design consultants are free to propose steel systems for design or cost considerations.

B. All roof decks are preferred to be concrete. Where the roof is supported by an approved structural steel deck, it is preferred that the steel deck be topped with lightweight concrete.

1.2 Architectural Concrete:

A. Exposed concrete as a finish material is acceptable to the University where determined to be appropriate during the design process.

END OF SECTION
SECTION 04000

MASONRY

1.1 Brick Masonry to be designed and constructed per the standards set by the Southern Brick Institute and Brick Institute of America.

1.2 Cavity Wall Unit Masonry

   A. Details and specifications should incorporate a continuous mat system for air space maintenance and drainage in the cavity wall such as CavClear Masonry Mat or similar.

   B. All weep holes should be protected from insect entry.

   C. All weep holes should be a minimum 8” above finished grade.

1.3 See also Section 07000 for flashing and waterproofing related to masonry systems

END OF SECTION
SECTION 05000

METALS

1.1 General Notes

A. Galvanic Reaction: Wherever dissimilar metals may come in contact with each other, they must be separated with an appropriate layer of bituminous coating. Galvanized metal or zinc plated fasteners shall not be used to anchor aluminum or copper. Use matching fasteners.

1.2 Structural Steel

A. All structural steel in exterior locations (such as cornices, parapets, or canopies) must be hot dipped galvanized or stainless steel.

B. Fireproofing: In order to achieve the Fire Rating required by the Building Code, it is the University’s preference that structural steel and steel decking be protected with gypsum board sheathing rather than sprayed fireproofing systems.

1.3 Metal Railings

A. It is the University’s preference that handrails should be aluminum or stainless steel with brushed satin finish. Painted steel railings should be avoided unless integral to the design intent or required by budget.

END OF SECTION
SECTION 06000

WOOD AND PLASTICS

1.1 Countertops

A. Use solid polymer material (Dupont “Corian” and similar products) for restroom and break area countertops and backsplashes when possible. Exceptions to this should be approved by the GSU Project Manager.

B. With the exception of restrooms, an acceptable alternate is to use plastic laminate on pressure treated wood.

1.2 Rough Carpentry

A. Fire retardant lumber, used where required by code, shall be in accordance with American Wood Preservers Association standards.

B. No composite materials such as: particle board, fiber board, masonite, OSB, etc, shall be used within 4” of the finish floor in areas where water may be present.

1.3 Architectural Millwork and Cabinetry

A. All architectural millwork and cabinetry shall meet AWI standards. Finish shall be free of lead-based substances.

B. The use of more durable solid surfacing materials for window sills is encouraged. Solid surface composite materials or plastic laminate on solid wood or exterior grade plywood is approvable. Standard particle board not acceptable substrate.

C. Countertops should minimize seams. Plastic laminate countertops should have plywood substrate. Sprayed on glue application for plastic laminate not recommended. Countertops in wet areas shall be constructed with substrate resistant to moisture.

D. All interior joints in cabinets where sinks will be installed shall be caulked.

E. At restroom lavatory counters it is the University preference to leave below counter piping and wiring exposed and not have cover panels that may create maintenance problems. Exception should be approved by the GSU Project Manager.

END OF SECTION
SECTION 07000

BUILDING ENVELOPE REQUIREMENTS

1.1 General
   A. Exterior envelope systems shall be selected with low maintenance longevity as the primary consideration. Also of primary consideration is the prevention of moisture penetration. EIFS and uncoated concrete masonry systems are not acceptable for permanent buildings.

1.2 Moisture Control
   A. Prevent moisture problems (underground). Provide sheet membrane waterproofing and positive slope foundation perimeter drains to grade. Use protection board over all membranes.
   
   B. Prevent moisture problems (above ground). Provide metal window and door head flashing, through-wall flashing, and counter flashing with 50-year minimum expected life. Slope all ledges and horizontal surfaces ¼ inch per foot minimum.

1.3 Roofing
   A. Roofing types: (unless otherwise approved by University).
      1. Low Slopes (flat to ¼ inch per foot slope) – modified bitumen membrane system.
      2. Medium Slopes (1/4 inch to 3 inches per foot slope) – 4 ply asphalt gravel or granular surface.
      3. High Slopes (3 inches per foot and steeper) – Standing seam metal panels with underlayment or heavy weight asphalt shingles with 2 ply underlayment.
   
   B. Specify manufactured equipment curbs (i.e., Pate or Thycurb) or raised (18” min.) equipment stands for all roof-mounted equipment, excluding Packaged Roof-top Units. Don’t allow equipment to be mounted on pressure treated wood, plastic pads or panels set directly on roof surface.
   
   C. Roofing material specifications shall require the use of “non-asbestos-containing material”. Roofing repair or replacement on roofs suspected of containing asbestos shall comply with regulations of the Georgia DNR, Environmental Protection Division.
   
   D. Disposal of asbestos containing roofing materials (over 1% asbestos) requires documentation that proper methods of disposal have been employed.
   
   E. All existing roofing systems have an approved and assigned roofing Contractor. All work must be completed by the approved and assigned roofing Contractor.
   
   F. Roof-mounted HVAC equipment shall be set on frames 24” above the roof level.
   
   G. Provide a parapet wall 42” about roof level around perimeter of roof.
   
   H. Provide anchors for window washer equipment.
I. Conduit pipes shall use gooseneck fittings when penetrating above the roof.

J. Provide airlocks or vestibules for roof openings from habitable floors that can be secured with locking devices. No direct access shall be provided to the roof from occupied floors.

K. Avoid surface riding blocking supports.

END OF SECTION
SECTION 08000

DOORS, WINDOWS AND GLAZING

1.1 Doors should be standard 3’ x 7’ x 1-3/4” where possible. Exterior doors should be 16 Gauge galvanized hollow metal type construction. Interior doors should be solid core wood, birch veneer, except that existing adjacent door veneers shall be matched in remodeling projects. If possible, where doors swing out, use a full height metal astragal for security. All Door Frames should be formed steel, 14 Gauge for exterior doors and 16 Gauge for interior doors. Frame miters shall be welded and ground smooth for exterior and masonry frames; drywall type for stud partition frames for interior.

1.2 All door hardware shall be institutional grade. Refer to specification Section 08710 DOOR HARDWARE. Approved lockset manufacturers: Best, Russwin, Schlage or Corbin (Emhart). All locksets shall accommodate Best 7 pin cores. Keyway selected by University Key Control Office. Best to provide cores directly to University c/o Key Control; provide for written receipt. University will provide keying schedule to Best in large jobs. Provide 3 change keys for each lock and 5 master keys for each master system. Do not provide key cabinets. All hardware shall use US26D finish unless otherwise approved.

1.3 Automatic door systems or Horton shall be provided at all major public entrances for ease of accessibility. Refer to specification Section 08460 AUTOMATIC ENTRANCE DOORS for Series 2003 Electric Belt Drive Operator with Aluminum Door Panels. Refer to specification Section 08470 AUTOMATIC ENTRANCE DOORS for Series 4000 Heavy Duty Electric Swing Door Operator.

1.4 Fire rated doors utilizing glazing shall use fire-rated glass (not wired glass) and conform to the size limitations set out in the applicable code.

END OF SECTION
SECTION 08460

AUTOMATIC ENTRANCE DOORS

HORTON AUTOMATICS SERIES 2003 ELECTRIC BELT DRIVE OPERATOR WITH ALUMINUM DOOR PANELS

Specifier Note: Coordinate and edit articles and paragraphs below to suit project requirements. Add section numbers and titles per CSI "Master Format" and specifier's practice. Consult with manufacturer regarding performance requirements for units applicable to project, as well as, related equipment and accessories required.

PART I - GENERAL

1.1 SUMMARY

A. WORK INCLUDED: Furnish complete automatic aluminum door system, as specified, that has been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

B. RELATED WORK:
   1. Masonry: Division 4, applicable sections.
   2. Electrical: Division 16, applicable sections.
   3. Storefront; Glass; Hardware: Division 8, applicable sections.
   4. Perimeter Sealants; Insulation: Division 7, applicable sections.

1.2 REFERENCES

A. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION:
   1. AAMA 101: Appendix Dissimilar Materials.

B. AMERICAN ASSOCIATION OF AUTOMATIC DOOR MANUFACTURERS (AAADM).

C. AMERICAN NATIONAL STANDARDS INSTITUTE:
   2. ANSI A156.10: For Power Operated Pedestrian Doors; Sliding Doors section.

D. AMERICAN SOCIETY FOR TESTING AND MATERIALS:
   1. ASTM B221: Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.

E. NATIONAL FIRE PROTECTION ASSOCIATION:

F. THE ALUMINUM ASSOCIATION:

G. UNDERWRITERS LABORATORY, INC.:
   1. UL 325: Electrical Door, Drapery, Gate, Louver, and Window Operators and Systems.
H. UNDERWRITERS LABORATORY OF CANADA (ULC).

1.3 SUBMITTALS

A. PRODUCT DATA: Submit manufacturer’s complete product and installation data.

B. SHOP DRAWINGS: Submit drawings showing layout, profiles, product components including anchorage, accessories, finish and glazing details (where required).

C. QUALITY ASSURANCE AND CLOSEOUT SUBMITTALS: Submit the following:
   1. Manufacturer's Operation and Maintenance Data.
   2. Warranty document as specified herein.
   3. AAADM inspection compliance form completed and signed by certified AAADM inspector prior to doors being placed in operation as proof of compliance with ANSI A156.10.

1.4 QUALITY ASSURANCE

A. INSTALLERS QUALIFICATIONS: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

B. MANUFACTURER’S QUALIFICATIONS: Manufacturer to have minimum (5) five years successful experience in the fabrication of automatic doors of the type required for this project. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.

1.5 WARRANTIES

A. MANUFACTURER’S WARRANTY: Units to be warranted against defect in material and workmanship for a period of one year from the Date of Substantial Completion. Manufacturer’s warranty is in addition to, and not a limitation of, other rights owner may have under Contract Documents.

B. DISTRIBUTOR’S WARRANTY: One year warranty: Labor and transportation charges for defective parts replacement.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions/openings by field measurements before fabrication and record on shop drawings. Coordinate with fabrication and construction schedule to avoid construction delays.
1.7 DELIVERY, STORAGE AND HANDLING

A. ORDERING AND DELIVERY: Comply with factory's ordering instructions and lead time requirements. Delivery shall be in factory's original, unopened, undamaged containers with identification labels intact.

B. STORAGE AND PROTECTION: Provide protection from exposure to harmful weather conditions and vandalism.

PART II - PRODUCTS

2.1 MANUFACTURER

A. Automatic sliding door(s) furnished and installed shall be of type(s) and size(s) specified and as indicated on plans and door schedule and shall be manufactured by Horton Automatics, a division of Overhead Door Corporation.

2.2 EQUIPMENT

A. MANUFACTURED DOOR UNITS: Shall include operator, header and track, jambs, sliding door panel(s), and sidelite(s). Units can be mounted within rough opening with sliding panel(s) sliding along sidelite; also, units can be surface mounted with sliding panel(s) sliding along wall. Units will be either single-slide or biparting and will be one of the following unit types:

1. Type 010: Sliding panel(s) shall slide along interior side.
2. Type 110: Slide-Swing panel(s) shall slide along exterior side.
3. Type 310: Slide-Swing panel(s) shall slide along interior side. Breakaway sidelite.
4. Type 410: Slide-swing panel shall slide between fixed sidelite/wall and breakaway sidelite.
5. Telescoping Door Type 010T, 110T, or 310T: Leading slide panel will open twice as fast as adjacent sliding panel. When unit slides in full open position, maximum slide opening will be approximately 70% of overall package width. Units will be either full or half telescoping.

B. OPERATOR: The Electric Operating Mechanism shall be Series 2003 Belt Drive. The operator shall be mounted and concealed within the header. Operating force shall be accomplished through a 1/8 HP DC permanent magnet motor with worm gear transmission and 1800 RPM working with drive belt, attached door hangers, and idler pulley. Drive belt to be Neoprene reinforced nylon, 3/4" (19 mm) wide. Idler pulley to be reinforced, non-metallic material.

1. The Microprocessor Master Control shall have Horton Version 2 software and have programmable speed values for: Open Speed, Close Speed, Open Check, Close Check, and Open Cushion; however, Close Speed not to exceed 12" (305 mm) per second.

2. The control shall also have programmable time values for: Full-Open Time Delay and Partial-Open Time Delay. Partial-Opening to be adjustable in
increments of 1" (25 mm). Modes of operation shall be: Auto-seal mode with self-close approximately every 11 seconds, Self-cycle test mode (operates door during tune-in process), Night mode power fail operation, Day mode autolock prevention, Day 1-way and 2-way, Night 1-way and 2-way. Diagnostics shall be accomplished via a digital display.

3. Control to have dedicated interface connection.

4. A Revolution Encoder shall instruct the control on sliding panel's speed and position. An Adjustable Reversing Circuit will reopen door unit if closing path is obstructed. Maximum force required to prevent sliding panel from closing = 28 lbf.

5. Finger Safety: When unit slides open, strike rail of sliding panel will stop 3 1/2" (89 mm) short of adjacent sidelite; resulting opening is net slide.

6. Power On/Off Switch: Shall be located inside header and when switched OFF, unit reverts to free manual operation (likewise during electrical power failure).

7. Operator Options:
   a. Autolock Fail Secure: If power fails the lock engages.
   b. Autolock Fail Safe: If power fails the lock disengages.
   c. Power Fail Open: If power fails the door slides open.
   d. Power Fail Close: If power fails the door slides closed.

C. HEADER: Shall be aluminum with removable face plate and capable of self-support up to length of 16 feet (4877 mm) on standard door size and glazing. Optional transom of size and type indicated mounted on header. Header size to be:

1. 6" (152 mm) deep by 6" (152 mm) high for Types 010, 110, 310 & 410
2. 8" (203 mm) deep by 6" (152 mm) high for Telescoping door types.

D. TRACK: Shall be be aluminum, 5/8" (8 mm) wide and replaceable. Telescoping doors will have two separate tracks for two-speed sliding panels to travel. Door-hanger Rollers will be non-metallic, sealed ball bearing wheels 1-3/4" (44 mm) diameter. Anti-Derailing shall be accomplished by means of a separate adjustable roller.

E. SLIDING PANEL(S) AND SIDELITE(S): Shall be aluminum, 1-3/4" (44 mm) deep with narrow stile horizontal and vertical rails. Weather-stripping to be along perimeter of sliding panel(s) and swingout sidelite(s). Concealed guides to stabilize bottom of sliding panel. Standard glazing prep to be for 1/4" (6 mm) glass

1. Emergency Egress: Slide-swing panels can swing out 90° from any position of slide movement and require no more than 50 lbf. (222 N) of force applied at the lock stile to open. Swing-slide panels and swing-out sidelites have torsion spring designed to re-close panel if pushed open in the direction of egress; also, include intermediate horizontal rail. Units with emergency egress feature are UL listed as an exit way and are compliant with NFPA 101.
2. Telescoping panels to have synchronizing cable and speed regulating mechanism. Standard glazing prep to be for 1/4" (6 mm) glass.

3. Sliding Panel and Sidelite Options:
   a. Medium stile horizontal or vertical rails.
   b. Additional and/or extra wide sidelites of size and type indicated.
   c. Recessed sidelite and track and non-threshold application.
   d. Horizontal muntin(s) of size and type indicated.
   e. Prep for glazing 5/16" (16 mm) to 1" (25 mm).

F. JAMBS/FRAME: Shall be aluminum. Jamb dimensions to be:
   1. 3/4" (44 mm) deep by 4" (102 mm) wide for Types 010, 110, & 310.
   2. 3/4" (44 mm) deep by 6" (152 mm) wide for Type 410 & all Telescoping door types.

G. THRESHOLD: Shall be aluminum, 1/2" (25 mm) tall by 4" (102 mm) wide.
   1. Optional threshold to be 7" (178 mm) wide.
   2. Threshold for Telescoping door type 310T to be 1/2" (25 mm) tall by 9" (229 mm) wide.

H. HARDWARE: Provided and installed in strike rail shall be:
   1. Hookbolt Lock latching into jamb or adjacent strike rail.
   2. Maximum Security Lock with 31/32" (25 mm) backset.
   3. Keyed Cylinder mounted on exterior side with 1 5/32" (29 mm) standard size cylinder.
   4. Thumbturn mounted on interior side.
   5. Lockbolt into breakout carrier frame or reverse into threshold.
   6. Hardware Options:
      a. Lockbolt into breakout carrier frame without hookbolt.
      b. Lock Indicator.
      c. Cylinder Guard.
      d. Cylinder Escutcheon.
      e. Panic Exit Device: Adams Rite 8600 (door type 310 only).
      f. Paddle Panic Exit Device: Jackson 1085P (not applicable to Telescoping units).

2.3 RELATED EQUIPMENT

A. BASIC SENSOR SYSTEM: 24 VAC, class II circuit:
   1. Motion sensors: Microwave sensor shall be header-mounted each side of door unit for detection of traffic each direction. Installer to adjust so that minimum width of detection pattern equals clear door opening, minimum projection out from threshold equals 43" (1092 mm), and detection is within 5" (127 mm) of closed door.

   2. Option: (recommended for Telescoping) Motion sensors with added threshold scan: Microwave sensor shall be header-mounted each side of door unit for
detection of traffic each direction. Sensor also includes active infrared presence sensor that provides additional threshold protection. Installer to adjust so that minimum width of detection pattern equals clear door opening, minimum projection out from threshold equals 54" (1372 mm), and detection is within 5" (127 mm) of closed door.

3. Hold-open beams: Two LED pulsed infrared photoelectric beams to be mounted in vertical rails of sidelite or in jambs at heights of 24" (610 mm) and 48" (1219mm). Sender/receiver arrangement parallels door opening: They shall be installed within 3" (76 mm) from the center to the slide door. The beams shall remain active from fully open to within 43" (1092 mm), of closed.

2.4 RELATED WORK REQUIREMENTS

A. ELECTRICAL: 120 VAC, 60 cycle, 1 phase, 15 amp. Non-North American voltages can be 240 VAC (operator must have 240 volt power supply).

B. GLASS AND GLAZING: Glass stops, glazing vinyl and setting blocks for field glazing as per Safety Glazing standard ANSI Z97.1.2. General contractor to coordinate acquisition of glass in thickness and type in accordance with manufacturer's recommendations for prescribed design.

2.5 MATERIALS, FINISHES AND FABRICATION

A. EXTRUDED ALUMINUM: ASTM B221, 6063-T5 alloy and temper, anodized:
   1. Structural Header Sections: Minimum 3/16" (5 mm) thickness.
   2. Structural Frame Sections: Minimum 1/8" (3 mm) thickness.
   3. Structural Panel Sections: Commercial grade.

B. FINISHES (for all exposed aluminum surfaces): Shall be one of the following:
   1. 204-R1 Clear: Arch. Class II Clear Anodized Coating, AA-M12C22A31.
   2. 313-R1 Dark Bronze: Arch. Class II Anodized Coating, AA-M12C22A32.
   3. 312-R1 Light Bronze: Arch. Class II Anodic Coating, AA-M12C22A32.
   4. 315-R1 Black: Arch. Class II Anodic Coating, AA-M12C22A32.
   5. Special Paint Coating: Color as selected.
   6. Clad with stainless steel or muntz metal (brass alloy): #7 or #4 finish.


D. FRAME CONSTRUCTION: Butt joints, neatly and mechanically secured by means of screws and formed aluminum corner brackets.

E. OPERATOR CONSTRUCTION: Electromechanical, modular type construction.
PART III - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Installer must verify that base conditions previously installed under other sections are acceptable for product installation according to manufacturer's instructions. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of work. Do not start work until all negative conditions are corrected in a manner acceptable to the installer and manufacturer.

3.2 INSTALLATION

A. GENERAL: Install door units plumb, level and true to line, without warp or rack of frames or sash with manufacturer’s prescribed tolerances. Provide support and anchor in place.

B. DISSIMILAR MATERIALS: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.

C. WEATHER-TIGHT CONSTRUCTION: Install header and framing members in a bed of sealant or with joint filler or gaskets. Coordinate installation with wall flashings and other components of construction.

D. ELECTRICAL: General or electrical contractor to install all wiring to operator on a separate circuit breaker routed into header.

3.3 CLEANING, ADJUSTMENT AND PROTECTION

A. CLEANING: After installation, installer to take following steps:
   1. Remove temporary coverings and protection of adjacent work areas.
   2. Remove construction debris from construction site and legally dispose of debris.
   3. Repair or replace damaged installed products.
   4. Clean product surfaces and lubricate operating equipment for optimum condition and safety.

B. ADJUSTMENT: Installer to adjust operator and controls for optimum condition and safety.

C. ADVISE CONTRACTOR: Of precautions required through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of acceptance.

HORTON AUTOMATICS SERIES 4000 HEAVY DUTY ELECTRIC SWING DOOR OPERATOR
Specifier Note: Coordinate and edit articles and paragraphs below to suit project requirements. Add section numbers and titles per CSI "MasterFormat" and specifier's practice. Consult with manufacturer regarding performance requirements for units applicable to project, as well as, related equipment and accessories required.

PART I - GENERAL

1.1 SUMMARY

A. WORK INCLUDED: Furnish complete automatic aluminum door system, as specified, that has been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

B. RELATED WORK:
   1. Masonry: Division 4, applicable sections.
   2. Electrical: Division 16, applicable sections.
   3. Labeled doors and frames; Hardware: Division 8, applicable sections.
   4. Perimeter Sealants; Insulation: Division 7, applicable sections.

1.2 REFERENCES

A. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION
   1. AAMA 101: Appendix Dissimilar Materials

B. AMERICAN ASSOCIATION OF AUTOMATIC DOOR MANUFACTURERS (AAADM)

C. AMERICAN NATIONAL STANDARDS INSTITUTE:
   2. ANSI A156.10: For Power Operated Pedestrian Doors; Swing Doors section.

D. AMERICAN SOCIETY FOR TESTING AND MATERIALS:
   1. ASTM B221: Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.

E. NATIONAL FIRE PROTECTION ASSOCIATION:

F. THE ALUMINUM ASSOCIATION:

G. UNDERWRITERS LABORATORY, INC.:
   1. UL 325: Electrical Door, Drapery, Gate, Louver, and Window Operators and Systems

H. UNDERWRITERS LABORATORY OF CANADA (ULC)

1.3 SUBMITTALS
A. PRODUCT DATA: Submit manufacturer's complete product and installation data.

B. SHOP DRAWINGS: Submit drawings showing layout, profiles, product components including anchorage, accessories, finish and glazing details (where required).

C. QUALITY ASSURANCE AND CLOSEOUT SUBMITTALS: Submit the following:
   1. Manufacturer's Operation and Maintenance Data.
   2. Warranty document as specified herein.
   3. AAADM inspection compliance form completed and signed by certified AAADM inspector prior to doors being placed in operation as proof of compliance with ANSI A156.10.

1.4 QUALITY ASSURANCE

A. INSTALLERS QUALIFICATIONS: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

B. MANUFACTURER’S QUALIFICATIONS: Manufacturer to have minimum (5) five years successful experience in the fabrication of automatic doors of the type required for this project. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.

1.5 WARRANTIES

A. MANUFACTURER’S WARRANTY: Units to be warranted against defect in material and workmanship for a period of one year from the Date of Substantial Completion. Manufacturer’s warranty is in addition to, and not a limitation of, other rights owner may have under Contract Documents.

B. DISTRIBUTOR’S WARRANTY: One year warranty - labor and transportation charges for defective parts replacement.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions/openings by field measurements before fabrication and record on shop drawings. Coordinate with fabrication and construction schedule to avoid construction delays.

1.7 DELIVERY, STORAGE AND HANDLING

A. ORDERING AND DELIVERY: Comply with factory’s ordering instructions and lead time requirements. Delivery shall be in factory’s original, unopened, undamaged containers with identification labels intact.
B. STORAGE AND PROTECTION: Provide protection from exposure to harmful weather conditions and vandalism.

PART II - PRODUCTS

2.1 MANUFACTURER

A. Automatic swing door operator(s) furnished and installed shall be of type(s) and size(s) specified and as indicated on plans and door schedule. Automatic swing door operator(s) to be manufactured by Horton Automatics, a division of Overhead Door Corporation.

2.2 EQUIPMENT

A. MANUFACTURED DOOR UNITS:

1. Type 4100: Surface Applied Operator with Connecting Arms: The operator header shall be mounted to the surface of the existing door frame or wall. Connecting hardware shall be a double arm arrangement that can either push the door or pull the door open to suit the job condition. When the operator mounting is on the pull side and adjacent wall is within 4" (102 mm) of the door frame, specify a parallel arm.

2. Type 4500: Overhead Concealed Operator, Door and Frame: The operator header is mounted directly over the door and serves as the door frame header. The cover shall be self-supporting to transom glass above. The operator output shaft shall connect to an arm that transmits power to the door via a slide block connected to the arm. The arm works in a track that is mounted in the top web of the door. The door pivot is independent of the operator. Direct drive optional.

   a. Swing door panel shall be aluminum, 1-3/4" (44 mm) deep, narrow stile vertical and horizontal rails. Lock and pivot rails shall have adjustable dual weather-stripping. Vinyl finger guards shall be provided. The following hardware shall be provided: Maximum security lock, push bar(s), pivots, finger guard(s), and threshold.

   b. Jamb/Frame members shall be 1-3/4" deep x 4" wide (44 mm x 102 mm).

3. Type 4800: Overhead Concealed Operator with Connecting Arm and Pivots: The operator header is mounted directly over the door and serves as the door frame header. The cover shall be self-supporting to transom glass above. The operator output shaft shall connect to an arm that transmits power to the door via a slide block connected to the arm. The arm works in a track that is mounted in the top web of the door. The door pivot is independent of the operator and the bottom door pivot is included. Direct drive optional.
B. OPERATOR: The Electric Operating Mechanism shall be Series 4000: operator shall be shock mounted and concealed in an extruded aluminum case 6" x 6" (152 mm x 152 mm) side access header cover or an optional 4 1/2" x 6" (114 mm x 152 mm) bottom access header cover. The operator shall be readily convertible to any hand required.

4. Opening force shall be accomplished by a 1/8 HP D.C. permanent magnet motor working through reduction gears to the output shaft. Gear train bearings shall be sealed ball bearing types. Closing force shall be supplied by a field replaceable Quadracoil™ spring (four independent coil springs separated by teflon discs and enclosed in an external spring box). Close speed control shall be accomplished by dynamic braking of the motor and shall be fully adjustable. Operator to act as a manual closer when power is off or when the master control unit is removed. An On/Off toggle switch shall be supplied.

5. The master control unit shall incorporate an adjustable time delay of 1 to 28 seconds. It shall provide infinite adjustment to opening and back check speeds including adjusting the opening force without affecting the opening speed. The master control unit shall provide for immediate reversal of door motion without undue strain on the drive train by supplying stepped voltage to the motor. The door shall reverse when closing if an object stops the door. A locked door motor protection circuit will be supplied that will shut off current to the motor if it is applied when the door is inadvertently locked or otherwise prevented from opening.

6. Option: Emergency Breakout for In-swinging doors. When door is in emergency breakout position, power shall be removed from the operator.

2.3 RELATED EQUIPMENT

A. BASIC SENSOR SYSTEM - 24 VAC, class II circuit: Vista™ package:

1. Motion sensor: Microwave unidirectional/bidirectional sensor shall activate the door (approach side).

2. Swing Side safety sensor: Active infrared sensor shall utilize a combination of focused and diffused technology. Sensor shall keep a closed door from opening or an open door from closing when safety zone (swing door area) is occupied.

   a. When door is in open position the swing side safety sensor shall provide threshold protection covering the full width of door overlapping into activating zone.

B. ENHANCED SENSOR SYSTEM- 24 VAC, class II circuit:
1. Option 1. Standard Vista™ package plus door mounted presence sensor(s): The sensor can be mounted on the swing side of the door at the strike edge of the door panel. It can be set to either slow or stop an opening door when someone (or object) enters its field of view. Another door mounted presence sensor can be mounted on the approach side for reopening the door if a person or object is in the swing path during the closing cycle.

2. The door mounted sensor is an advanced presence sensor that uses active infrared technology to provide safety zone protection for swing doors. It incorporates distance measurements and is insensitive to reflectiveness of the floor surface.

3. Option 2. Standard Vista™ package plus safety beam: In lieu of door mounted presence sensor(s), a safety (sentinel) beam can be mounted at the end of guide rails as an extra safety device. The door stops if the beam is interrupted during the opening cycle and to ensure the area is clear before resuming normal operation, it slowly seeks the full open position. The safety beam offers extra safety beyond the strike edge of the door. This option is cost effective for use on a pair of swing doors.

C. GUIDE RAILS: Shall be of type selected and to be provided on swing side of door unless protected by adjacent wall.

2.4 RELATED WORK REQUIREMENTS

A. ELECTRICAL: 120 VAC, 60 cycle, 1 phase, 15 amp. Non-North American voltages can be 240 VAC (operator must have 240 volt power supply)

B. GLASS AND GLAZING: Glazing Materials: Glass stops, glazing vinyl and setting blocks for field glazing as per Safety Glazing standard ANSI Z97.1.2. General contractor to coordinate acquisition of glass in thickness and type in accordance with manufacturer's recommendations for prescribed design.

2.5 MATERIALS, FINISHES AND FABRICATION

A. EXTRUDED ALUMINUM: ASTM B221, 6063-T5 alloy and temper, anodized:
   1. Structural Header Sections: Minimum 1/8" (3 mm) thickness.
   2. Structural Frame Sections: Minimum 1/8" (3 mm) thickness.
   3. Structural Panel Sections: Commercial grade.

B. FINISHES (for all exposed aluminum surfaces): Shall be one of the following:
   1. 204-R1 Clear: Arch. Class II Clear Anodized Coating, AA-MI2C22A31.
   2. 313-R1 Dark Bronze: Arch. Class II Anodized Coating, AA-MI2C22A32.
   3. 312-R1 Light Bronze: Arch. Class II Anodic Coating, AA-MI2C22A32.
   4. 315-R1 Black: Arch. Class II Anodic Coating, AA-MI2C22A32.
   5. Special Paint Coating: Color as selected.
   6. Clad with stainless steel or muntz metal (brass alloy): #7 or #4 finish.

D. FRAME CONSTRUCTION: Butt joints, neatly and mechanically secured by means of screws and formed aluminum corner brackets.

E. OPERATOR CONSTRUCTION: Electromechanical.

PART III - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Installer must verify that base conditions previously installed under other sections are acceptable for product installation according to manufacturer's instructions. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of work. Do not start work until all negative conditions are corrected in a manner acceptable to the installer and manufacturer.

3.2 INSTALLATION

A. GENERAL: Install door units plumb, level and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.

B. DISSIMILAR MATERIALS: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.

C. WEATHER-TIGHT CONSTRUCTION: Install header and framing members in a bed of sealant or with joint filler or gaskets. Coordinate installation with wall flashings and other components of construction.

D. ELECTRICAL: General or electrical contractor to install all wiring to operator on a separate circuit breaker routed into header.

3.3 CLEANING, ADJUSTMENT AND PROTECTION

A. CLEANING: After installation, installer to take following steps:
   1. Remove temporary coverings and protection of adjacent work areas.
   2. Remove construction debris from construction site and legally dispose of debris.
   3. Repair or replace damaged installed products.
   4. Clean product surfaces and lubricate operating equipment for optimum condition and safety.
B. ADJUSTMENT: Installer to adjust operator and controls for optimum condition and safety.

C. ADVISE CONTRACTOR: of precautions required through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of acceptance.

END OF SECTION
SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following:
   1. Hinges
   2. Continuous Hinges
   3. Pivots
   4. Key control system
   5. Lock cylinders and keys
   6. Lock and latch sets
   7. Bolts
   8. Exit devices
   9. Push/Pull units
   10. Closers
   11. Overhead holders
   12. Miscellaneous door control devices
   13. Door trim units
   14. Protection plates
   15. Weather stripping for exterior doors
   16. Sound stripping for interior doors
   17. Automatic drop seals (door bottoms)
   18. Astragals or meeting seals on pairs of doors
   19. Thresholds

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 08110: Steel Doors and Frames
   2. Section 08210: Wood Doors
   3. Section 08410: Aluminum Entrances and Storefronts
   4. Division 16: Electrical

1.3 REFERENCES:
A. Standards of the following as referenced:
   1. American National Standards Institute (ANSI)
   2. Door and Hardware Institute (DHI)
   3. Factory Mutual (FM)
   4. National Fire Protection Association (NFPA)
   5. Underwriters’ Laboratories, Inc. (UL)
      a. UL 10C - Fire Tests Door Assemblies
   6. Warnock Hersey

B. Regulatory standards of the following as referenced:

1.4 SYSTEM DESCRIPTION:

A. Refer to applicable Headings for system description for electric and electro-pneumatic hardware products.

1.5 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. Product data including manufacturers' 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.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

   1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format "hardware sets" indicating complete designations of every item required for each door or opening. Use specification Heading numbers with any variations suffixed a, b, etc. Include the following information:
      a. Type, style, function, size, and finish of each hardware item.
      b. Name and manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
      e. Explanation of all abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for hardware.
      g. Door and frame sizes and materials.
      h. Keying information.
      i. Cross-reference numbers used within schedule deviating from those specified.
1) Column 1: State specified item and manufacturer.
2) Column 2: State prior approved substituted item and its manufacturer.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.

3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

E. Contract closeout submittals:
   1. Operation and maintenance data: Complete information for installed door hardware.
   2. Warranty: Completed and executed warranty forms.

1.6 QUALITY CRITERIA

A. Supplier Qualifications:
   1. The finish hardware supplier shall be a factory authorized distributor with office and warehouse facilities within a 100-mile radius of Atlanta, Georgia.
   2. The finish hardware supplier shall have a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
   3. The finish hardware supplier shall employ an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the work, for consultation.

B. The hardware manufacturer's representative(s) shall conduct a pre-installation conference with the Contractor's installer, a representative of the county planning and/or maintenance department, and a representative of the hardware supplier, to demonstrate product installation and adjustment in accordance with manufacturer's recommendations and Owner's requirements.

C. Hardware manufacturers' representative shall inspect hardware installation to confirm that all products are installed and adjusted according to manufacturer's recommendations. A certificate of compliance shall be submitted with the project closeout documents.

1.7 PRODUCT HANDLING:
A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repack in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.8 WARRANTY:

A. Special warranties:
   1. Door Closers: Ten year period
   2. Exit Devices: Three year period

1.9 MAINTENANCE:

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

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS:

A. Hinges:
   1. Acceptable manufacturers:
      a. Hager Hinge Company
      b. Stanley Works
      c. McKinney
   2. Characteristics:
      a. Templates: Provide only template-produced units.
      b. Screws: Provide Phillips flat-head screws complying with the following requirements:
i) For metal doors and frames install machine screws into drilled and tapped holes.
ii) For wood doors and frames install threaded-to-the-head wood screws.
iii) For fire-rated wood doors install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.
iv) Finish screw heads to match surface of hinges or pivots.

c. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:
i) Out-Swing Exterior Doors: Non-removable pins.
ii) Out-Swing Corridor Doors with Locks: Non-removable pins.
iii) Interior Doors: Non-rising pins.
iv) Tips: Flat button and matching plug. Finished to match leaves.
v) Size: Size hinges in accordance with specified manufacturer’s published recommendations.
vi) Quantity: Furnish one pair of hinges for all doors up to 5'0" high. Furnish one hinge for each additional 2-1/2 feet or fraction thereof.

B. Continuous Hinges:
1. Acceptable manufacturers:
   a. Markar
   b. Select Products*
   c. Zero

2. Characteristics:
   a. Continuous gear hinges to be manufactured of extruded 6063-T6 aluminum alloy with anodized finish, or factory painted finish as scheduled.
   b. All hinges are to be manufactured to template. Uncut hinges shall be non-handed and shall be a pinless assembly of three interlocking extrusions applied to the full height of the door and frame without mortising.
   c. Vertical door loads shall be carried on chemically lubricated polyacetal thrust bearings. The door and frame leaves shall be continually geared together for the entire hinge length and secured with a full cover channel. Hinge to operate to a full 180°.
   d. Hinges to be milled, anodized and assembled in matching pairs. Fasteners supplied shall be 410 stainless steel, plated and hardened.
   e. Provide UL listed continuous hinges at fire doors. Continuous hinges at fire doors (suffix -FR) shall meet the required ratings without the use of auxiliary fused pins or studs.
   f. Provide continuous hinges at restroom doors.

C. Pivot Sets:
1. Acceptable manufacturers:
   a. Dor-O-Matic
   b. Glynn Johnson
   c. LCN, Division of Ingersoll-Rand*
2. Characteristics:
   a. Pivots to be high strength forged bronze with top pivot housing with spring activated bronze retracting pin. Pivots to have tilt-on bearing and bearing pin.
   b. Center hung pivots to support doors up to 300 pounds. Jamb portion of top center pivot to fit into a 1- 3/4" header.

D. Cylinders:

1. Acceptable manufacturers:
   a. Best Access Systems

2. Characteristics:
   a. Review the keying system with the Owner and provide the type required (master, grandmaster or great-grandmaster), either new or integrated with Owner's existing system.
   b. Equip locks with cylinders for interchangeable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these when directed.
   c. Furnish final cores and keys for installation by Owner.
   d. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
   e. Comply with Owner's instructions for master-keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
   f. Key Material: Provide keys of nickel silver only.
   g. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system. Deliver keys to Owner.

E. Locksets, Latchsets, Deadbolts:

1. Acceptable manufacturers:
   a. Best Access Systems 35H Series x 14H

2. Mortise Locksets and Latch-sets: as scheduled.
   a. Chassis: cold-rolled steel, handing field-changeable without disassembly.
   b. Latch-bolts: 3/4-inch throw stainless steel anti-friction type.
   c. Lever Trim: through-bolted, accessible design, cast or solid rod lever as scheduled. Spindles: independent break-away.
   d. Thumb-turns: accessible design not requiring pinching or twisting motions to operate.
   e. Deadbolts: stainless steel 1-inch throw.
   f. Electric operation: Manufacturer-installed continuous-duty solenoid.
   g. Strikes: 16 gage curved stainless steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
   h. Scheduled Lock Series and Design: Schlage L Series, 17A Design.
i. Certifications:
   i) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
   ii) ANSI/ASTM F476-84 Grade 30 UL Listed.

F. Exit Devices:
   1. Acceptable manufacturers:
      a. Von Duprin, Division of Ingersoll-Rand, CD98/98 Series

2. Characteristics:
   a. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware."
   b. All exit devices mounted on labeled wood doors shall be thru-bolted mounted on the door per the door manufacturers’ requirements.
   c. All trim shall be thru-bolted to the lock stile case.
   d. All exit devices shall be made of brass, bronze, stainless steel, or aluminum material, plated, anodized, or powder coated to the standard architectural finishes to match the balance of the door hardware.
   e. Provide glass bead conversion kits to shim exit devices on doors with raised glass heads.
   f. All exit devices shall be one manufacturer. No deviation will be considered.
   g. All series exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. All exit devices shall be non-handed. Touchpad shall extend a minimum of 1/2 of the door width and shall be a minimum of 2-3/16" in height. Plastic touchpads are not acceptable. All latchbolts to be the deadlocking type. Latchbolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latchbolts are not acceptable. Plastic linkage and “dogging” components are not acceptable.
   h. Lever trim shall be solid case material with a break-away feature to limit damage to the unit from vandalism.
   i. Surface vertical rod devices shall be UL labeled for fire door (180 and 90 minute metal doors and 20 minute wood doors) applications without the use of bottom rod assemblies. Where bottom rods are required for security applications, the devices shall be UL labeled for fire doors applications with rod and latch guards by the device manufacturer.

G. Closers and Door Control Devices:
   1. Acceptable manufacturers:
      a. LCN Closers, Division of Ingersoll-Rand 4011, 4111-EDA, 4111-CNS, 4111-S-CNS

2. Characteristics:
   a. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
   b. All closers shall utilize a stable fluid withstanding temperature range of 120°F to -30°F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided
with temperature stabilizing fluid that complies with standards UBC 7-2 (1997) and UL 10C.

c. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check.

d. All closers shall have solid forged steel main arms (and forearms for parallel arm closers) and where specified shall have a spring loaded stop on the closer shoe ("Spring Cush"). Where door travel on out-swing doors must be limited, use "CNS or S-CNS" type closers. Auxiliary stops are not required when cush type closers are used.

e. Over-head concealed closers shall have spring power adjustable for 50% increase in closing power and fully mortised door tracks.

f. All closers shall be certified to exceed ten million (10,000,000) full load cycles by a recognized independent testing laboratory. All closers (overhead, surface and concealed) shall be of one manufacturer and carry manufacturer’s ten-year warranty (electric closers to have two year warranty).

g. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA and ANSI A-117.1 provisions for door opening force.

h. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.

i. Powder coating finish to be certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.

j. Combination Door Closers and Holders: Provide units designed to hold door in open position under normal usage and to release and automatically close door under fire conditions. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts. Where Combination Door Closers, Holder, and Detectors are scheduled, provide integral UL Listed photo-electric 24V detector module.

k. Closers shall be provided with fully deep drawn powder coated metal covers (no seams).

H. Power Operators:

1. Where low kinetic energy, as defined by ANSI Standard A1 56.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered 4620 Series operators complying with the 1990 ADA for opening force and time to close standards.

2. Full closing force shall be provided when the power or assist cycle ends.

3. All power operator systems shall include the following features and functions:

   a. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical Code, section 725-31.
b. When an obstruction or resistance to the opening swing is encountered, the operator will continue attempting to open the door. If the obstruction or resistance remains, the operator will again pause the door.

c. The operator will be designed to prevent damage to the mechanism if the system is actuated while the door is latched or if the door is forced closed during the opening cycle.

d. All covers, mounting plates and arm systems shall be powder coated and successfully pass a minimum of 100 hours testing as outlined in ANSI Standard A156.18.

e. UL listed for use on labeled doors.

f. All operators shall be non-handed with spring power over a range of at least four sizes; either 1 through 4 or 2 through 5.

g. Provisions in the control box or module shall provide control (inputs and outputs) for; electric strike delay, auxiliary contacts, sequential operation, fire alarms systems, actuators, swing side sensors, stop side sensors.

4. [4610, 4620] All electrically powered operators shall include the following features or functions:

a. When an obstruction or resistance to the opening swing is encountered, the operator will pause at that point, then attempt to continue opening the door. If the obstruction or resistance remains, the operator will again pause the door.

b. Easily accessible main power and maintain hold open switches will be provided on the operator.

c. An electronically controlled clutch to provide adjustable opening force.

d. A microprocessor to control all motor and clutch functions.

e. An on-board power supply capable of delivering both 12V and 24V outputs up to a maximum of 1.0 ampere combined load.

f. All input and output power wiring shall be protected by slow blow fuses. These fuses shall be easily replaceable without special tools or component replacement.

5. Actuators shall have a stainless steel touch plate that measures 4-1/2" in diameter and features a blue filled handicap symbol. The actuator shall be weather resistant and provide normally open momentary contacts. The actuator is designed to mount in a standard single gang box (2" wide, 4" high, and 2" deep).

6. Power door operators will provide a two (2) year warranty.

7. The contractor shall furnish a certificate executed by a representative of the manufacturer of the door closers that all closers have been inspected and adjusted, are operating as designed and have been installed in accordance with the manufacturer’s instructions.

8. Installation of the automatic door operators shall be done by a trained installer skilled in the installation of automatic door operators and equipment. Factory training provided by the operator manufacturer is recommended. All low
voltage switch hookups are the responsibility of the operator installer, as well as temporary wiring hookup to plug into wall outlet for test of system. Final hookup of 115VAC power will be handled by and coordinated with the general contractor’s electrical contractor.

I. Overhead Door Holders:
1. Acceptable manufacturers:
   a. Glynn Johnson, Division of Ingersoll-Rand*
   b. Rixson Firemark
2. Characteristics:
   a. Provide heavy duty door holders of stainless steel.
   b. Holder to be installed with the jamb bracket mounted on the stop.

J. Floor Stops and Wall Bumpers:
1. Acceptable manufacturers:
   a. Glynn Johnson*
   b. Ives
   c. Rockwood Manufacturing
2. Characteristics: Refer to Hardware Headings.

K. Door Bolts/Coordinators:
1. Acceptable manufacturers:
   a. Glynn Johnson*
   b. Ives
   c. Rockwood Manufacturing
2. Characteristics:
   a. Flush bolts to be forged brass 6-3/4" x 1", with 1/2" diameter bolts. Plunger to be supplied with milled surface one side which fits into a matching guide.
   b. Automatic flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
   c. Self-latching flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
   d. Automatic flush bolts and self-latching flush bolts shall be UL listed for fire door application without bottom bolts (LBB).
   e. Coordinator to be soffit mounted non-handed fully automatic UL listed coordinating device for sequential closing of paired doors with or without astragals.
   f. Provide filler pieced to close the header. Provide brackets as required for mounting of soffit applied hardware.

L. Push Plates:
1. Acceptable manufacturers:
   a. Glynn Johnson
   b. Ives
   c. Rockwood Manufacturing*
2. Characteristics:
a. Exposed Fasteners: Provide manufacturers standard exposed fasteners.
b. Material to be extruded/forged, stainless steel, per the Hardware Headings.
c. Provide plated sized as shown in Hardware Headings.

M. Door Pulls & Pull Plates:
1. Acceptable manufacturers:
   a. Glynn Johnson
   b. Ives
   c. Rockwood Manufacturing*
2. Characteristics:
   a. Provide concealed thru-bolted trim on back to back mounted pulls, but not for single units.
   b. Material to be extruded/forged/cast, stainless steel.
   c. Provide units sized as shown in Hardware Headings.

N. Push Pull Sets:
1. Acceptable manufacturers:
   a. Glynn Johnson
   b. Ives
   c. Rockwood Manufacturing*
2. Characteristics:
   a. Provide mounting systems as shown in hardware sets.
   b. Material to be (description - i.e. solid rod, tubular, cast etc.) stainless steel.
   c. Provide Push/Pull sets sized as shown in Hardware Headings.

O. Protective Plates:
1. Acceptable manufacturers:
   a. Glynn Johnson
   b. Ives
   c. Rockwood Manufacturing*
2. Characteristics:
   a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
   b. Materials:
      i) Metal Plates: Stainless Steel, .050 inch (U.S. 18 gage).
3. Fabricate protection plates not more than 2 inches less than door width on hinge side and not more than 1 inch less than door width on pull side.
4. Heights:
   a. Kick plates to be 10 inches in height.
   b. Mop plates to be 4 inches in height.
   c. Armor plates to be 34 inches in height. Armor plates on fire doors to comply with NFPA 80.

P. Thresholds:
1. Acceptable manufacturers:
a. National Guard Products, Inc.*
b. Reese Industries
c. Zero Weather-stripping Co., Inc.

2. Types: Indicated in Hardware Headings.

Q. Weather-stripping:
1. Acceptable manufacturers:
   a. National Guard Products, Inc.*
   b. Reese Industries
   c. Zero Weather-stripping Co., Inc.
2. Types: Indicated in Hardware Headings.

R. Silencers:
1. Acceptable manufacturers:
   a. Glynn Johnson
   b. Ives
   c. Rockwood Manufacturing*
2. Three for each single door; four for pairs of doors.

S. Key Cabinet and System:
1. Acceptable manufacturers:
   a. Telkee, Inc.
2. Provide a 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 percent of the number of locks required for the Project.
3. Provide hinged-panel type cabinet for wall mounting.

T. Magnetic Door Holders
1. Acceptable manufacturers:
   a. LCN, Division of Ingersoll-Rand
   b. Rixson-Firemark
   c. Edwards
2. Wall mounted 24vdc units with finish to match door hardware.

2.2 MATERIALS AND FABRICATION:

A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of
hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

1. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

2. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of adequately fastening the hardware. Coordinate with wood doors and metal doors and frames where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.3 HARDWARE FINISHES:

A. Match items to the manufacturer’s standard color and texture finish for the latch and lock sets (or push-pull units if no latch of lock sets).

B. Provide finishes that match those established by ANSI or, if none established, match the Architect’s sample.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer’s standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

1. Hinges (Exterior) 630 (US32D) Satin Stainless Steel
2. Hinges (Interior) 652 (US26D) Satin Chrome Plated Steel
3. Continuous Hinges 628 (US28) Clear Anodized Aluminum finish to match doors @ aluminum entrance systems
4. Flush Bolts 626 (US26D) Satin Chrome Plated Brass/Bronze
5. Locks 630 (US32D) Satin Stainless Steel
6. Exit Devices 628 (US28) chassis, 626 (US26D) covers, and 630 (US32D) touchpads
7. Door Closers 689 (AL) Powder Coat
8. Push Plates 630 (US32D) Satin Stainless Steel
9. Pull Plates 630 (US32D) Satin Stainless Steel
10. Protective Plates 630 (US32D) Satin Stainless Steel
11. Door Stops 626 (US26D) Satin Chrome Plated Brass/Bronze
12. Overhead Holders 630 Satin Stainless Steel
14. Weather-stripping Aluminum

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.

B. Install each hardware item in compliance with the manufacturer’s instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

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

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."

F. Weather-stripping and Seals: Comply with manufacturer’s instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING:

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Door Hardware Supplier's Field Service

1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.

2. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

3. File written report of this inspection to Architect.

D. Prior to project completion, representatives of the lock, exit device and overhead closer manufacturer(s) shall inspect and adjust all units and certify that all units are installed in accordance with the manufacturer’s instructions, and are regulated properly and functioning correctly. A written report shall be provided to the Architect as to the inspection and shall include appropriate certificates.

END OF SECTION
SECTION 09000
FINISHES

09 00 00 FINISHES

09 29 00 Gypsum Board
1.1 Drywall Construction
   A. Partitions: Provide 5/8" gypsum board on 3-5/8" 20-gauge metal studs at 16" o.c. with
      snap-in 1 5/8" cold rolled channel stiffeners through studs at mid-span. Insulate
      partitions surrounding restrooms, classrooms, conference rooms and other sound
      sensitive spaces with sound batts and apply acoustical caulking at joints with other
      surfaces.
   
   B. Extend room partitions through ceiling and anchor to structure above when sound
      attenuation is needed. Provide sound insulation battens for sound control around
      offices, conference rooms, rest rooms and other sensitive areas.
   
   C. Do not terminate partitions at ceiling grid without prior approval. If approved, trim top
      edge of gypsum board partition with ceiling system trim, white finish.
   
   D. Exterior walls to be 3 5/8" 20-gage metal studs at 24" o.c. minimum, or more as
      structurally required, to facilitate future rewiring. Brace studs to structure for additional
      stiffness as needed.
   
   E. At minimum, use 5/8" thick gypsum board panels on all stud walls and partitions.

   F. All public corridors shall receive corner guards, and are to be approved by the
      University's Project Manager and the Interior Design Specialist.

   G. New walls shall be finished to Level 2. New walls scheduled to receive graphics or
      other special treatment shall be finished to a Level 5.

09 82 00 Gypsum Board Fire-Proofing
2.1 Specify that all penetrations be sealed with fire-stop.
2.2 Extend all corridor partitions to structure. Enclose all storage, mechanical and electrical
   rooms with at least one hour rated walls or more as Building Code requires.

09 40 00 INTERIOR DESIGN
1.1 Consultant shall provide site visits as needed to record existing conditions.
1.2 All CAD floor and building plans provided by GSU shall be used for reference purposes
    only. Consultant is responsible for field-verifying all existing dimensions and conditions
    prior to submitting drawings.
1.3 Consultant shall review all finish and material palettes/selections with University Project
    Manager prior to presentation to end user. Consultant shall take care to refrain and/or
    minimize the use of light-color and solid upholstery and carpet selections.
1.4 Consulting firm shall provide the following drawings as a minimum:
   A. Site / Building Plan
   B. Partition Demolition Plan
C. Dimensioned Partition Plan  
D. Furniture Plan  
E. Reflected Ceiling Plan  
F. Power and Telecom  
G. Millwork Details  
H. Interior Elevations  
I. Schedules – Door & Hardware and Finish  

1.5 All drawings shall use GSU project number, project name, and Facilities-approved room numbers.  

1.6 All proposed finish and furniture selections will be submitted to and approved by the University’s Project Manager and Interior Design Specialist. Submittal shall be in form of a presentation board, 11”x17” minimum size with actual paint colors, material samples, fabric swatches, and furniture cut sheets.  

1.7 Deliverables shall include, but not be limited to, one (1) 24x36 hard copy of as-builts and one (1) AutoCAD CD at completion of project. A binder containing material finish samples and colors used shall be provided to the University’s Project Manager upon project completion.  

09 50 00 CEILINGS  

09 51 23 Acoustical Tile Ceilings  

1.1 Consultant shall specify acoustical tile to be 2 ft. x 2 ft., 3/4” thick, white tegular edge design equal to Armstrong Cirrus, unless otherwise approved in writing from University Project Manager. For renovation projects, match existing tile if available. For unconditioned spaces tile to be equal to Armstrong Fine Fissured Ceramaguard with hold down clips.  

1.2 For clean rooms specify hot dipped galvanized or aluminum with 1-1/2” wide flanges. In unconditioned spaces specify hot dipped galvanized or aluminum.  

1.3 Offices, classrooms, utility areas, corridors – Armstrong “Fissured” # 756, white.  

1.4 Lobbies, major conference rooms, major public areas – Armstrong Cirrus Tegular, # 534, white.  

1.5 In major public areas, alternate ceiling systems may be proposed but all product, design and color must be approved in writing in preliminary design phase by University Project Manager.  

09 60 00 FLOORING  

09 61 00 Flooring Treatment  

1.1 Wet utility (custodial) areas to be finished with quarry tile, heavy duty seamless flooring or high performance architectural coating (epoxy resin).  

1.2 Mechanical, electrical and data communication rooms to be finished with high performance architectural coating, and may be a lower cost alternative for some wet utility areas where quarry tile flooring is specified.  

1.3 Toilet and rest rooms to be finished with ceramic tile on the floor with cove base. Coordinate with tile wall finishes where required. Coordinate with floor drain requirements, see Mechanical Plumbing Section.  

1.4 Laboratories to be finished with heavy duty seamless flooring.  

1.5 Dry utility areas (closets, store rooms, file rooms, etc.) to be finished with vinyl composition tile. Base to be continuous rubber roll 4” cove base.
1.6 Hard flooring systems (such as terrazzo), porcelain, ceramic or heavy duty seamless flooring may be considered for main lobbies, atriums or where appropriate. Prior approval by the GSU Facilities is required.

1.7 Stairs, including fire exit stairs, may be finished with premium grade rubber treads. Compatible sheet rubber flooring may be used on landings. Risers may be painted. Premium grade rubber treads do not include products with wax and low rubber content.

1.8 Raised computer room access floors must be clean and dust free under the access floor system. Specify a clear concrete sealer on concrete floors under access floors.

09 68 13 Tile Carpeting

2.1 Carpet Tile Products:
   A. Standard 18 inch by 18 inch tiles (no metric).
   B. Solid backing with synthetic fabric scrim
   C. Glue pattern with 8 ft. x 8 ft. diagonal cross grid
   D. 28-34 ounce face weight - 22 ounce minimum acceptable only with prior approval by the GSU Facilities.
   E. Twenty pound tough bind
   F. Gage and stitch should be nearly square
   G. Nylon fiber type 6 or 6-6
   H. Consultant shall specify pressure-sensitive, direct glue down method only.
   I. Level loop or multi-level loop. Cut pile (cut / un-cut) shall be acceptable where cut pile percentage equals thirty percent (30%) or less of two (2) square yards.

09 68 16 Sheet (Broadloom) Carpeting

4.1 Broadloom Carpet Products:
   A. Level loop or multi-level loop. Cut pile (cut / un-cut) shall be acceptable where cut pile percentage equals thirty percent (30%) or less of two (2) square yards.
   B. 28-34 ounce face weight - 22 ounce minimum acceptable only with prior approval by the GSU Facilities.
   C. Twenty pound tough bind.
   D. Gage and stitch should be nearly square.
   E. Nylon fiber type 6 or 6-6.
   F. Install carpet direct glue down.

09 65 00 Resilient Flooring

4.1 Vinyl composition Tile (VCT) – Armstrong, Standard Excelon, 12” x 12”, 1/8” gauge or equal. (Use waterproof mastic for vinyl tile applied to elbow grade floor slabs.)

4.2 Approved manufacturers include Azrock and Armstrong.

09 65 13 Resilient Base and Accessories

5.1 Rubber wall base to be continuous (manufacturer coil lengths) roll four-inch (4") cove base. Six-inch (6") cove base acceptable for renovation projects where six-inch 6" is existing or where ceiling heights accommodate six-inch base. Do not specify straight base.

5.2 Approved manufacturers include Roppe and Johnsonite.

5.3 Transition strips to be rubber.

5.4 Due to building irregularities, specify job-formed corners.

09 70 00 WALL FINISHES
1.1 The coating for all exterior metal for GSU buildings (window frames, door frames, storefront framing, curtain wall framing, coping, gutters, down spouts, etc.) to be equal to Duron Industrial Coating, Satin Bronze-tone color.
1.2 Special coating systems for high traffic walls are preferred over vinyl wall covering.
1.3 Metal and wood to be finished with alkyd or latex satin enamel.
1.4 To correct existing rough walls, specify covering them with an underliner fabric.
1.5 Paint- Wall paint must be flat latex or eggshell finish.
1.6 At Restrooms provide 4’-0” minimum wall tile at all wet walls. Provide wall tile behind all hand dryers and paper towel dispensers if possible.

09 72 16 Vinyl-Coated Fabric Wall Coverings
2.1 Per the Building Code requirements, all wall covering to be Type II fabrics.
2.2 Paint shall not be installed over existing nor new wall covering.

09 90 00 PAINTING AND COATING

09 91 13 Exterior Painting
1.1 All exterior paint colors must be approved by Facilities Design & Construction Services, University Relations, and the President’s office in writing prior to work beginning.

09 91 23 Interior Painting
2.1 All paint color selections to be reviewed and approved by the GSU Facilities. Limit the number of different colors to facilitate future maintenance. Major public space paint colors must be approved by University Relations, and the President’s office in writing prior to work beginning.
2.2 Walls should have a minimum of 50% light-value colors and have a latex eggshell or satin finish. Flat finishes are discouraged, particularly in high traffic areas. Special coating systems (for example, Zolatone) are acceptable only with prior written approval from the GSU Facilities.
2.3 Doorframe paint must be oil enamel. Acceptable manufacturers include Sherwin Williams, Duron, and Benjamin Moore.
2.4 Acceptable manufacturers include Sherwin Williams, Duron, and Benjamin Moore.

END OF SECTION
SECTION 10000

SPECIALTIES

1.1 Signage

A. Interior Signage shall conform to the current manual issued by Georgia State University Signs and Graphics Department.

B. Exterior Signage shall comply with the logo, font, graphics, and colors designated by the University through the Office of University Relations. All exterior signage are subject to approval by the Office of University Relations and by the Facilities Department prior to fabrication.

C. Directory signage shall be approved by the Facilities Department prior to fabrication. Directories are based on APCO design 2310 Visuline series with fiberglass panels, metal cowling, aluminum sign bands and paper inserts. Doors shall be lockable.

1.2 Toilet Compartments

A. Toilet compartments shall be stainless steel unless approved otherwise by Project Manager in low traffic minimum abuse locations. Floor mounted, overhead braced systems are preferred, whenever feasible.

1.3 Toilet Accessories

A. Soap dispensers shall be selected in consultation with the Project Manager and GSU Building Services staff. For planning purposes wall hung dispensers are preferred to in counter systems.

B. Hand-dryers shall be used in most locations unless acoustical concerns exist or users request is approved by Project Manager. Preferred hand dryer types are the Dyson “Airblade” model AB-04 or Xcelerator model XL-BW. Locations near sinks are desired when possible.

C. Paper towel dispensers, when used, are provided by the University Office of Facilities Building Services. Locations near sinks are desired in addition to near entry doors. Project Manager may determine whether to use hand dryers or paper towel dispensers

D. Toilet tissue dispensers shall be stainless steel and accommodate two 10” diameter rolls. The basis of design shall be Bobrick B-2892 Surface Mounted Twin Jumbo Roll Toilet tissue Dispenser.

E. Sanitary Napkin disposal receptacles should be surface mounted type in each toilet stall, not thru partition type serving two stalls. Stainless steel finish.
F. Mirrors: Individual mirrors at each lavatory are preferred in most situations especially in restrooms subject to heavy student use. Large single mirrors for multiple lavatories may be used with approval of Project Manager.

G. Stainless Steel Shelves are desirable above urinals and in HC stalls when space allows.

H. Trash Receptacles should be freestanding units and scheduled as toilet accessories. Receptacles should not have lids.

I. Diaper Changing Stations: wall mounted flip down units are to be provided in all restrooms available for general public use if at all possible.

1.4 Visual Display Surfaces

A. Visual Display Wall Coverings are intended for use with dry-erase makers and/or projection surface consisting of low-gloss, plastic film bonded to fabric backing, not less than 17-mil total thickness. Basis of design shall be Walltalkers. Aluminum frame shall be field applied snap-on trim with manufacturer's standard box type chalk tray.

B. Preparation of wall: Comply with manufacturer's written instructions for surface preparation.
   1. New Drywall: Provide a level 5 finish at new drywall applications. Follow with a good quality pigmented acrylic wall covering primer recommended in writing by wall covering manufacturer for intended substrate. Sand smooth and brush marks left from primer.
   2. Painted Surfaces: the resilience of moisture must be tested. Moisture sensitive paint should be sanded or washed with ammonia to remove the paint.
   3. New Plaster: Wall shall cure for 60 to 90 days and be checked with a moisture meter. Moisture content should not exceed 4%. After surface is prepped per instructions provided above, apply a good quality pigmented acrylic wall covering primer recommended in writing by wall covering manufacturer for intended substrate.

C. Below are listed the different type of Visual Display Surface Applications:
   1. For projection purposes only use: Walltalkers nu.vu.rite
   2. For dry erase markers and projection purposes combined: Walltalkers erase.rite
   3. For dry erase markers only: Walltalkers ez-rite. This product shall be used in all rooms that are equipped with a projection screen.

END OF SECTION
SECTION 11000

EQUIPMENT

1.1 No specific requirements – design/material recommendations per design Consultant’s professional advice.

1.2 All items shall be coordinated with university’s Project Manager.

END OF SECTION
DIVISION 12000

FURNISHINGS

12 00 00 FURNISHINGS

12 05 13 Fabrics
1.1 Per the Building Code requirements, all wall covering to be Type II fabrics.
1.2 All finishes shall be selected for ease of maintenance and durability. Consultant shall select upholsteries with no less than 100,000 double rubs for student spaces. No upholsteries with less than 60,000 double rubs shall be accepted in any University space. Crypton-protected and other water and stain resistant fabrics are recommended.
1.3 Consultant shall take care not to specify light-colored fabrics/upholsteries nor tone-on-tone and/or solid fabrics/upholsteries.

12 10 00 Art
2.1 All public art must be approved in writing by University Project Manager, prior to purchase and installation.

12 20 00 WINDOW TREATMENTS

12 21 00 Window Blinds
3.1 Recommended window manufacturers include Levlor.

12 22 00 Curtains and Drapes
3.2 Fabric curtains and drapes are not for use on University property unless otherwise specified and approved in writing.

12 24 00 Window Shades
3.3 Consultant shall specify alabaster or light-colored window treatments, unless otherwise approved in writing from University Project Manager.
3.4 Recommended window manufacturers include Levlor and Mechoshades.
3.5 Motorized shades in student spaces shall have protective plastic cover installed over controls to prevent tampering. Plastic key shall be specified for all tamper-resistant covers.

12 25 00 Window Treatment Operating Hardware
3.6 All operating hardware shall have a minimum ten (10)-year warranty on parts and a minimum two (2) years on labor.
3.7 All operating hardware must be secured so as to prevent tampering.

12 40 00 FURNISHINGS AND ACCESSORIES

12 48 00 Rugs and Mats
4.1 Unsecured rugs and mats are not permissible for University spaces unless approved in writing by the University Project Manager.

12 50 00 FURNITURE
5.1 All furnishings shall be selected from manufacturers and vendors on the current State Procurement Contract. Exceptions shall only be approved for furniture where no similar or equal function exists on the current State Procurement Contract. Furniture vendor must provide maintenance service plan to Project Manager prior to furniture approval.

5.2 All furniture selections shall be provided to the University Project Manager no less than three (3) days prior to client presentation.

12 51 00 Office Square Footages

5.3 The following approximate minimum office square footages shall be taken into consideration during Programming:

A. President 450 SF
B. Provost 350 SF
C. Vice President / Dean 300 SF
D. Assistant / Associate Provost 180 SF
   Assistant / Associate Dean
   Assistant Vice President
   Chair / Director / Department Head
E. Assistant / Associate Director 150 SF
   Assistant Chair
   Assistant Department Head
   Manager
   Head Coach
F. Faculty / Professor 120 SF
   Assistant / Associate Professor
   Assistant Manager
G. Visitor / Part-Time Faculty 120 SF
   Emeritus
H. Office 90 SF
   Open Office (Managerial) 96 SF
I. Open Office (Special Equip Needs) 80 SF
J. Open Office (Standard) 64 SF
K. Open Office (Shared) 64 SF
L. Open Office (GRA / Student Asst) 45 SF
M. Reception (1 Person) 45 to 64 SF
N. Reception (2 Persons) 90 to 135 SF
O. Reception Seating 36 to 108 SF
   (2 to 6 Persons)
P. Conference Rooms 120 to 450 SF
   (4 to 18 Persons)

5.4 Consultant shall provide specific furniture in accordance to the program for each project.

5.5 General Classrooms:
A. Consultant shall provide seating with adequate circulation for no less than 40 students. Audio-visual requirements are to be coordinated with GSU’s IS&T department, including instructor stations.
B. Fixed Seating – Fixed seating shall be 20” wide minimum. Proper spacing should be allowed for a variety of body types and persons with disabilities.

12 90 00 OTHER FURNISHINGS
6.1 Bicycle racks shall conform to the “ribbon rack” design in blue color. All racks shall be secured to the ground. Final color to be approved by the University Project Manager in writing.

6.2 Consultant shall provide coated metal grid or coated slatted assemblies that shall be secured to the ground.
SECTION 13000

SPECIAL CONSTRUCTION

1.1  No specific requirements – design/material recommendations per design Consultant’s professional opinion/advice.

1.2  All items shall be coordinated with university’s project Manager.

END OF SECTION
SECTION 13700
SECURITY ACCESS AND SURVEILLANCE

CCTV SYSTEM SPECIFICATION

SYSTEM DESCRIPTION
The system shall be CCTV contractor furnished / CCTV contractor installed. Primary monitoring for the system including camera control and recording/playback shall be at the main Security Desk and any PC designated as a viewing station. System shall be provided with unlimited user licenses permitting monitoring of live and playback video at locations specified herein. The system shall consist of video cameras for operation in low light level (Day/Night) cameras for operation outdoors, High Resolution domes for indoor operation, camera brackets, exterior camera housings, camera power supplies, pan/tilt/zoom domes, camera remote controls, digital recorders, management software, monitors, wiring as necessary to provide a complete working system.

Cameras shall be installed in key interior and exterior locations. All camera wiring will terminate in the main communication room or at the direction of the client. Digital recorders will be connected to the end user supplied Ethernet switches, so that any PC with management software installed will have access to remote viewing.

Scope of Work
Security Company will install and CCTV system with Digital Video Recording. The Digital Video Recorder will be located in the IT room or in a location determined by the client and have a Monitor at the unit. All camera cabling shall be run back to the Digital Recorder. The Digital Video Recorder will be able to record up to 30 days of video. Camera mounting locations and camera types shall be determined by working with clients personnel. Recommended quantities of particular camera models are included in the specifications to follow. The digital recorder shall be connected to the owner provided LAN via network connections supplied by the client. Contractor shall work in conjunction with the clients IT/Maintenance Department to program the network information into the units and establish connectivity. Contractor is responsible for field verification of all cable run lengths and routes. All cabling shall be terminated and certified. System shall be installed by a GE Security authorized reseller with GE Security trained technicians.

While integration with Access Control/Intrusion is not included in the present scope of work, the CCTV System (both new and existing equipment) shall be capable of fully integrating with GE Access Control and/or Intrusion System (one software GUI to manage all security breaches including door and video alarms).

Training
User training shall be provided for staff that will operate and maintain the system. Provide 8 hours of training for staff who will operate the system. Technical training shall be provided for the owner’s maintenance personnel; technical training shall include basic system trouble shooting, programming for DVR, tours for PTZ domes, repairs, adjustments and required preventive maintenance. The 8 hours of training can be requested throughout the 1st year of operation. Computer Based Training Modules must be provided for staff covering the operation of the recorders and the management software.
Warranty
Provide at a minimum a full system parts and labor warranty covering materials and workmanship for a period not less than one-year following system acceptance. Manufacturer's warranty on parts only shall be for a three year period. Manufacturer of equipment shall provide for a 365 day advanced replacement program for any product found defective.

Documentation
Operation manuals shall include a minimum of two copies of complete system manuals from the equipment manufacturer. A minimum of two hard copies and one soft copy (i.e. provided on CD disc) of as built drawings showing all devices and cable runs shall be provided and turned over to the owner. Provide at a minimum a full system warranty covering materials and workmanship for a period of one-year following system acceptance.

1.1 CCTV - Cameras

A. Indoor/Outdoor Fixed Mini-dome – Super WDR – High Impact
The Indoor/Outdoor camera shall be weatherproof to an IP66 rating and features a high impact die cast housing, impact-resistant Lexan dome and tamperproof screws. This enclosure shall have dimensions of 4.3”H x 5.32”W. The camera shall be a high resolution 540TVL with .5lux @ f1.2. The camera shall utilize Xposure technology for extreme backlight applications where direct sunlight affects the camera view. The operating temperature shall be -58 degrees to 122 degrees F. The camera shall accept 10 to 40VDC or 18 to 30VAC. The signal to noise ratio shall be >50dB. The Outdoor camera shall be the GE Security Model # GEC-DRX-VA3/GEC-DRXU-VA3 (UTP) or pre-approved equivalent, the flush mount kit shall be the DR-FM, wall mount DR-RWM, pendant mount DR-PDM, and outside corner mount DR-OCM. Indoor Camera – GE Security Model # GEC-DMX-VA3, or pre-approved equivalent – the above mounts cannot be used with the GEC-DMX-VA3.

B. Indoor/Outdoor Fixed Rugged Mini-Dome Camera – WDR – High Impact
The Indoor (if needed)/Outdoor camera shall be weatherproof to an IP66 rating and features a high impact die cast housing, impact-resistant Lexan dome and tamperproof screws. This enclosure shall have dimensions of 4.3”H x 5.32”W. The camera shall be a high resolution color 500TVL with .5lux @ f1.2. The camera shall include a 3mm to 8mm or 9mm to 22mm vari-focal auto iris lens depending on mounting location. The camera shall accept 10 to 40VDC or 18 to 30VAC. The signal to noise ratio shall be >50dB. The power consumption shall be 3.4W at 24VAC. The camera shall be the GE Security Model # GEC-DRH-VA3/GEC-DRHU-VA3 (UTP) or GEC-DRH-VA9/GEC-DRHU-VA9 (UTP) or pre-approved equivalent. The mounting adapter required will depend on camera location. The flush mount kit shall be the DR-FM, wall mount DR-RWM, pendant mount DR-PDM, and outside corner mount DR-OCM. Indoor Camera – GE Security Model # GEC-DMH-VA3, or pre-approved equivalent – the above mounts cannot be used with the GEC-DMH-VA3.

C. Indoor Mini-Dome Camera – Low Impact
The housing shall utilize a three-axis gimble to allow for optimization of the field of view in various mounting locations. The housing shall include a secondary video
output inside the dome bubble for local test monitor during setup. The camera shall be a high resolution color 540 TVL with a sensitivity of 0.5 lux at f1.2, 30 IRE. The operating temperature shall be 14 degrees to 122 degrees F. The camera shall include a 3mm to 8mm or 9mm to 22mm vari-focal auto iris lens depending on mounting location. The camera shall accept 10 to 40VDC or 18 to 30VAC. The signal to noise ratio shall be >50dB. The power consumption shall be 3.5W at 24VAC. The camera shall be the **GE Security Model # GEC-DME-VA3/GEC-DMEU-VA3 (UTP) or GEC-DME-VA9/GEC-DMEU-VA9 (UTP)** or pre-approved equivalent.

D. Outdoor Camera Enclosure – wall mount
The outdoor camera enclosure shall be weatherproof to an IP66 rating and be manufactured from die-cast aluminum construction. This enclosure shall have usable internal dimensions of 10.6" x 3" x 3". This unit shall incorporate a flip top design for easy access. The unit shall include interchangeable cable access. The unit shall also include a heater, die cast aluminum sunshield and die cast aluminum wall mount. The camera enclosure shall be the **GE Security Model # KTE400** or pre-approved equivalent.

E. Outdoor Fixed Camera & Lens – Day/Night
The outdoor camera shall be a high resolution DSP 1/3” CCD image sensor with 500TVL lines of color resolution with 0.5lux at 1.2f in day mode and 0.1lux in B/W mode. Camera shall provide wide dynamic range capability. The camera shall accept 10 to 40VDC / 18 to 30 VAC input voltage (reverse polarity protected) and have a signal to noise ratio of greater than 50dB. The camera shall have an operating temperature from -4 degrees to 122 degrees. The power consumption shall be 3.3w. The camera shall conform to the internationally recognized compliance standard: FCC, UL, CE and C-Tick. The lens will be an auto iris varifocal type 2.7mm-13.5mm, 5mm-50mm or 7mm to 70mm. Lens shall have a zoom ratio of 5 or 10 & be CS mount. Installation location will determine the setting for the lens focal length. The camera shall be the **GE Security Model # GEC-HDR1-DN (camera), KTL-2.7-13VA, KTL5-50VA or KTL-7-70VA (lens)** or pre-approved equivalent.

F. Outdoor Pan/Tilt Zoom Camera
This unit shall include Silktrak direct drive technology for smooth operation. The pan travel shall be 360 degrees continuous and have a tilt travel of 184 degrees. This unit shall include 16 shadow tours with 20min total duration. The unit shall include 32 macros with 16 steps each. The unit shall include 8 no/nc programmable alarm inputs and 2 form C relay outputs. The operating temperature shall be -40 to 122 degrees F. With heater/blower. The enclosure shall be gray in color and allow for a variety of mounting configuration, including: wall, ceiling, pendant and flush mounting. The lower dome shall provide a variety of types, including: Clear and Smoked types. Unit shall be a ¼” CCD sensor with 36x or 26X (see camera matrix) optical and 12x digital zoom. Resolution shall be 470TVL with a sensitivity of 1.0lux @ 1/60 sec, .07lux @ ¼ sec in color mode and 580TVL with a sensitivity of .15lux @ 1/60 sec, .01lux @ ¼ sec in B/W mode. Lens field of view shall be 3.5mm (54.2 degrees) wide to 91mm (2.2 degrees) tele. Unit shall include spherical privacy masking and single hand insertion and removal of PTZ drive. Unit shall include built-in coax and UTP video connections. Operating voltage shall be 24VAC and have a power requirement of 60W at start up and 36W running with heater/fan. The environmental enclosure shall be IP66 rated and measure 9.5" in dia. X 9.6" high. The camera shall be the **GE**
Security Model # GEA-CE3-D36N or GEA-CE3-D26N or pre-approved equal. When connecting to multiple PTZ units a data distributor will be required to control multiple domes. The data distributor shall be GE Security Model # KTD83 or pre-approved equivalent.

G. Indoor Pan/Tilt/Zoom Camera
The Camera shall be in a flush mount ceiling housing is designed for in-ceiling applications. A T-Bar support kit shall be included. Unit shall be manufactured from ABS plastic with optical clear or smoked lower dome. The environmental enclosure shall have an IP50 rating. The enclosure shall be 9.5 in diameter x 9.6 in high. Weight of housing and PTZ – 6lbs., 8.5oz. The Camera shall be high sensitivity and high resolution with a Digital Signal Processing CCD image sensor. The Camera must have minimum of 470 TVL of horizontal resolution. The lens shall provide 4.1mm (wide) to 73.8mm (tele) F1.4 to F3.0. The angle of view shall be 48 degrees (wide) to 2.8 degrees (tele). The sensitivity shall be 0.7 lux at 1/60 sec NTSC and .05 lux at ¼ sec NTSC. Video output shall be 1.0 V p-p. The Camera shall be equipped with a ¼ in image sensor and a 18x optical zoom lens and 12x digital zoom. The PTZ shall provide direct drive motors with SilkTrak for smooth operation. The direct drive motors shall provide a preset positioning accuracy of 0.015 degrees. The camera shall be capable of 16 ShadowTours with 20 min total duration, 127 programmable presets with titles. The PTZ drive shall provide manual pan and tilt speed of 0.01 to 120 degrees/second. The operating temperature without heater/blower shall be 32 to 122 degrees F and with heater/blower shall be -40 to 122 degrees F. The PTZ shall provide 360 degrees continuous pan travel and 184 degrees of tilt travel. The operating voltage shall be 24VAC and require 30W startup and 16W running w/o heater/blower and require 60W startup and 36W running w/ heater/blower. Unit shall include built-in coax and UTP video connections. The PTZ camera shall be a GE Security Model# GEA-F3-D18N (flush mount) or GEA-C3-C18N (wall mount) or pre-approved equivalent. When connecting to multiple PTZ units a data distributor will be required to control multiple domes. The data distributor shall be GE Security Model # KTD83 or pre-approved equivalent.

H. Mounting Adapters – Outdoor PTZ
The outdoor PTZ may require a variety of mounting devices, depending on location of install. A site survey will determine the best solution for mounting each PTZ. The mounting devices shall be GE Security Model# GEA-104 parapet swing arm, GEA-105 corner mount, GEA-106 pole mount, GEA-107 roof mount or pre-approved equivalent.

I. PTZ Data Distributor – RS422 (only required for PTZ applications)
The data distributor shall have a 1 input and 6 output or 1 input and 16 output capability. This is used to disperse RS422 control signal along separate control lines. The connections are made on a removable terminal strip. The unit shall be the GE Security Model# KTD83, KTD83-16 or pre-approved equivalent.

J. CCTV – Controller Keypad
The Keypad shall have RS422/RS485 and RS232 communication ports to allow for operation and programming with GE Security SymDecs, SymSafe, DVMR’s and Pan-Tilt-Zoom cameras. The Keypad shall have zone system partitioning to allow viewing of up to 32 zones, with up to 64 cameras in each zone. The Keypad shall have
security level features so that authorized personnel may program through confidential access codes. The Keypad shall have a backlit liquid crystal display and built-in annunciation that alerts user attention is needed when a call-in occurs. The Model shall be **GE Security Model# KTD-405** or pre-approved equivalent.

### 2.1 COLOR MONITOR

**A. Color LCD Monitor 15/17/20”**

The Monitor shall have a resolution of no less than 500 TV lines and an actual viewing area of 15.0”, 17.1” & 20.1” inches diagonally. The Monitor shall have easily accessible front panel controls and on-screen display. The Monitor will also contain automatic loop through inputs, composite video and s-video inputs and outputs. The Monitor shall be capable of looping and have inputs that are self-terminating to allow for either stand-alone usage or the ability to daisy chain with other CCTV devices. The monitor shall have a contrast of 500:1 (TYP) and a display color of 16.7 million colors. The monitor display mode shall be: Video 1.0 Vp-p 75 ohms, BNC In/Out, Y/C In/Out, Audio In/Out, and NTSC. The monitor light source lifetime shall be rated at 50,000 hours. Power consumption shall be 50W max. The Monitor shall be capable of functioning at temperatures ranging from 32 to 104 degrees F. The dimensions shall be (15”) 13.07”H x 13.9”W x 4.74”D, (17”) 14.6”H x 14.8”W x 6.7”D, (20”) 19.9”H x 18.7”W x 7.2”D. Viewing angle shall be min 160 degrees / 160 degrees. Regulatory approval shall include: FCC, UL, CUL, and CE. The Model shall be **GE Security Model # KLC-15HS, KLC-17HS, KLC-20HS** or pre-approved equivalent.

### 3.1 Digital Recording & Video Management

**A. Digital Video Recorder**

The digital recorder shall use MPEG4 compression for video and MPEG1 compression for audio. The unit shall have the ability to record up to 16 analog cameras and 2 digital cameras all at 15pps and all at D1 resolution (720x480) simultaneously. The Unit shall have Ethernet connectivity built-in (LAN/WAN) connectivity. The Unit shall support composite video output; BNC composite (1), VGA (1), DVI (1). Unit shall incorporate triplex functionality for displaying multi-camera images whether live or playback while unit continues to record. The Unit shall support Pan-Tilt-Zoom camera control across an Ethernet connection. The Unit shall allow simultaneous live or playback connections that allow each user to view desired cameras via included client software. The Unit shall have per camera recording rates and quality levels. The Unit shall have powerful search filters that provide fast identification of alarm, event or general video by time/date, camera and event type. The Unit shall have Smart SearchTM motion search filter that allows searching recorded video for specific activity on any area of the screen. Unit shall allow access to live and or recorded video via client software and provide browser access to live and recorded video. Unit shall provide automatic, proactive health checks of the system (monitoring temperature thresholds of the hard drive(s), the temperature inside the unit, and fan functionality) – any breaches of the health checks shall trigger alerts (audible alarms, red alarm lights on unit and/or email notification). Unit shall provide hard drive failover (if one drive is lost, the unit continues to function normally by writing to the remaining drive(s). Embedded processor with Real Time Operating (RTS) provides fast start-up (less than 10 seconds). Unit shall have hard drives available in 640GB, 1TB, 1.5TB (in the same
chassis) in a 16 channel unit. The Model shall be **GE Security Model # SymSafe16Pro+2-1.5T** or pre-approved equivalent.

B. Digital Recorder Management Software
The management software shall allow simultaneous live or playback connections that allow each user to view desired cameras via included client software. Client software shall allow video to be streamed directly to a personal computer and view video streams from the SymDec digital recorders. The software shall allow users to load on any number of client workstations at no additional cost. The software includes an address book that lets the user enter information on each specific site that includes description, IP address, Ethernet connection type, unit type and camera quantity. Controlled access to multiple SymDec recorders can be set for multiple users. Each user is assigned to a group that has specific access rights to some or all of the sites in a system. Software shall be compatible with existing GE CCTV recorders. The goal is to have one software GUI for NCSS video management. The software shall be **GE Security Model # GE Nav2.0 & SymBrowser or pre-approved equivalent.**

4.1 CCTV Camera Power Supply
The Power Supply shall provide either one (1), four (4) or eight (8) isolated 24VAC fused outputs that can power devices requiring one (1) amp, 100VA or less. The Power Supply shall be located and mounted in a 12”x12”x4” durable key lock enclosure. The enclosure shall also contain a punch down block for power terminations. The operating temperature shall be 14 to 122 degrees F. The power supply shall be housed in a lockable metal enclosure and be UL listed. The Power Supply specified shall be **GE Security Model # KTP-24-16-200, KTP-24-4I-400, KTP-24-8, KTP-24-8I-400 KTP-24-4I-200 and KTP-24 or pre-approved equivalent.**

4.2 Wiring Requirements

A. All data cable shall be 100 Ohm, .5mm, unshielded twisted pair (UTP), 24 AWG, plenum rated with solid copper conductors. Cables shall exceed ANSI/TIA/EIA-568-B.2 Category 5 enhanced requirements and the spool shall be labeled as such. Cables shall be tested to 250 MHz. Cables shall be UL or ETL verified to exceed Category 5E requirements and cable jacket shall be labeled to indicate verification. All copper CCTV video cabling shall be RG-6/U 18 AWG, plenum-rated cable. Cable shall be equipped with 95% copper braid. Power cabling shall be sized per required distances, but will typically be 18 AWG.

4.3 INSTALLATION

A. The Security Contractor shall install all system components and appurtenances in accordance with the manufacturer’s specifications, referenced practices, guidelines, and applicable codes. Furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
B. All wiring is to be installed in dedicated conduit throughout. Cable shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring.

C. All low voltage wiring outside the control console, cabinets, boxes, and similar enclosures, shall be plenum rated where required by code.

D. All wiring conductors connected to terminal strips shall be individually numbered and each cable or wiring group being extended from a panel or cabinet to a building mounted device shall be identified with the name and number of the particular device as identified and shown on building drawings.

E. All exposed wiring inside and outside the control console, cabinets, boxes, and similar enclosures, shall be dressed down neatly and secured with wiring cleats or wire ties.

F. All exposed metallic flexible conduit and armored cable shall be dressed down neatly and secured with low profile, metal fasteners.

G. All cabinets, boxes, and similar enclosures containing security system components and/or cabling and which are easily accessible to employees or to the public shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible.

H. All junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamper proof screws.

I. System devices identified on building drawings are intended to generally indicate areas where such devices are to be located. Security Contractor shall be responsible for determining final location of these devices in accordance with OWNER’S requirements.

J. Digital video recorders and camera power supplies shall be connected to an Uninterruptible power supply. Security contractor responsible for proper size and performance to meet project requirements.

END OF SECTION
SECTION 14000

CONVEYING SYSTEMS

1.1 Elevators

A. Provide three complete sets of final job specific wiring diagrams, operating and maintenance manuals, parts manuals and troubleshooting guides. Provide all user and service codes for all diagnostic equipment. Provide copy of all Adjuster’s notes. Provide all equipment to service unit, including all proprietary equipment.

B. Provide all special diagnostic equipment, meters or monitors with instructions and operating manuals needed to trouble shoot or repair elevators. Proprietary computer hardware and software, used in initial installation may not be removed from the system.

C. Provide written guarantee that the Contractor will sell to the Owner any parts or troubleshooting equipment needed to repair or maintain elevator equipment.

D. Provide maintenance and callback service on each elevator after it is completed and placed in operating order for a period of 1 (one) year.

E. For hydraulic elevators, provide safety sleeve for jack.

F. Approved manufacturer for all controllers shall be Motion Control Engineering.

G. Elevator cab lighting—provide fluorescent T-8 lamps with electronic ballasts with plastic safety sleeves.

H. Provide key locks for independent service, fire service inspection, emergency stop, lights and fan. (Four [4] keys for each lock). Provide MEDECO keys as University standard. Key numbers will be provided by University.

I. Provide ADA- hands free communication with direct dial telephone line to police; one button push. Provide with flush surface (not inside cabinet). No doors; surface mounted in panel only.

J. Provide wall panels in all elevator cabs with hangers for safety pads.

K. Provide safety pads in all elevator cabs 1 set for each cab.

L. Provide service cabs with diamond-patterned industrial grade steel flooring. Passenger elevators to use terrazzo or other durable material to match the flooring of the building lobby.
M. Approved product: “Tuffex”

N. Provide fire service to meet standard ASME A17.1, 2 & 3 – 1996 edition with Georgia Amendments.
O. Provide voice announcer.

P. Provide Braille and tactile numbers and labels.

Q. Provide instructions for fire service etched into panel.

R. Provide 2 copies of “Design Certificates” to University.

S. Provide directional indicator lantern lights in hoist way opening jamb at each floor and car position indicator at main entry levels.

T. Shaft ways exposed to exterior environment (i.e. parking garages) shall be provided with humidity control to prevent water condensation on rails and operating mechanisms, with all landings protected from water entry.

U. Elevator Machine Rooms shall be air-conditioned according to specification Section 15000 Mechanical Narrative.

V. Refer to specification Section 14420 Wheelchair Lift. Hydraulic with safety load limit of 750 pounds.

W. Service elevators shall have their machine rooms located on the upper roof level or penthouse of the building. Access to machine rooms shall be by means of a permanent stair (not ladder).

X. Access to elevator penthouses/mechanical rooms shall be programmed and key-controlled to limit entry to authorized personnel only. Keying shall be coordinated with GSU Key Control.

Y. All elevators shall have side, double doors.

Z. Passenger elevators shall have a minimum of 10’ high ceilings; service elevators shall have a minimum of 14’ high ceilings.

AA. Preferred elevator cab finishes are Forms + Surfaces Series 2000. Equivalent products may be used contingent on approval by the GSU Project Manager.

BB. Minimum dimensions for Passenger elevator cabs to be 8’ 10” x 6’ 0”. Service elevators to have larger dimensions than the Passenger cab.

CC. Provide one Ground Fault Circuit Interrupt outlet and associated electrical components in each cab.
DD. Provide two extra paired wires and coaxial in travelling cable.

END OF SECTION
SECTION 14420

WHEELCHAIR LIFTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Inclined wheelchair lifts.

1.2 DEFINITIONS

A. Lift: Complete lift assembly including drive system, guide rails, buffers (if any), platform, runway enclosures and gates, access panels, signals, control system, electrical wiring, and devices necessary to provide specified or “Code” required performance, operations, safety, and security.

1.3 SUBMITTALS

A. Product Data: For each type of lift indicated. Include rated capacities, dimensions, performances, operations, safety features, controls, and finishes.

B. Shop Drawings: For each lift, show plans, elevations, and details. Show interfaces with other work, including loading on structure, together with indication of required clearances.

C. Maintenance Manuals: For each different lift, include operating and maintenance instructions, parts list with sources indicated, recommended parts inventory list, emergency instructions, and similar information. Submit for University's information at Project Closeout as specified in Division 1 Sections.

D. Inspection and Acceptance Certificates: Include operating permits as required by governing authorities for normal, unrestricted use of lifts.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage the lift manufacturer or an installer approved by the lift manufacturer who has completed lift installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Regulatory Requirements: In addition to local governing regulations, comply with Part XX of ASME A17.1, “Safety Code for Elevators and Escalators”, hereafter, the “Code”.
C. Regulatory Requirements: In addition to local governing regulations, comply with Part XXI of ASME A17.1, “Safety Code for Elevators and Escalators”, hereafter, the “Code”.

1.5 MAINTENANCE SERVICE

A. Maintenance: Beginning at Substantial Completion, provide 12 months full maintenance by skilled employees of the lift Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper lift operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Inclined Wheelchair Lifts:
      a. Access Industries, Inc.
      b. Dover accessibility Products, Inc.
      c. Garaventa (Canada) Ltd.
      d. Hiro Lift USA, Inc.
      e. Thyssen Elevator North America

2.2 MATERIALS

A. Steel Plates, shapes, and Bars: ASTM A 36 (ASTM a 36M).

B. Steel Tubing: Either cold- or hot-formed steel tubing.

C. Steel Pipe: ASTM A 53; standard weight (Schedule 40), unless otherwise indicated or required by structural loads.

D. Carbon-steel Sheet: Either cold- or hot-rolled, commercial-quality carbon steel.

F. Aluminum: Alloy and temper recommended by aluminum producer and finisher for
type of use and finish indicated, and with not less than strength and durability
properties of alloy and temper designated below for each aluminum form required.

G. Stainless-steel Floor Plate: ASTM A 793.

H. Glass: Comply with requirements of Division 8 Section 08000 Doors, Windows and
Glazing.

I. Acrylic Glazing: ASTM D 4802, Category A-1 (cell-cast) or Category A-2 (continuous
cast), Finish 1 (smooth or polished), clear or tinted as indicated.

J. Inserts: Furnish required concrete and masonry inserts and similar anchorage
devices for installing structural members, guide rails, machines, and other lift
components where installation of devices is specified in another specification section.

K. Expansion Anchors: Anchor-bolt-and-sleeve assembly of material indicated below
with capability to sustain, without failure, a load equal to 10 times the load imposed as
determined by testing per ASTM E 488 conducted by a qualified independent testing
agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633,
      Class Fe/Zn 5.
   2. Material: Group 1, alloy 304 or alloy 316 stainless-steel bolts and nuts
      complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F
      836M).

L. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-
gaseous grout complying with ASTM C 1107.

2.3 INCLINED WHEELCHAIR LIFTS

A. Systems and Machinery: Provide manufacturer’s standard pre-engineered lift
systems as indicated in published product literature and as follows:
   1. Rated Capacity: 450 lb (204 kg).
   2. Rated Speed: 18 fpm (0.10 m/s).

B. Power Supply: 120V, 60 Hz, 1 phase.

C. Drive System: Battery operated drive with recharging system.

D. Manual Lowering: Provide means to manually lower units in case of malfunction or
power loss.

E. Concealed Wiring: Enclose wiring within housings of units. Do not use conduit
exposed to view.
F. Automatic Folding Platforms: When not in use, platforms automatically fold up against wall to minimize projection into stairway.

G. Platform: 0.123-inch (3.1-mm) thick, galvanized steel sheet with black rubber flooring.

H. Automatic Ramps: Provide ramps matching platforms to transition from floor to lift platform. Ramps lower to floor automatically when lifts reach landing and unit stops. Ramps rise automatically when lift control is activated for lift to leave landing.

I. Supporting Structure: Provide structural-steel framing to support vertical loads from floor or stair treads and only lateral loads from walls.

J. Accessories: Provide units with the following accessories:

   1. Tubular-steel, manually operated safety arms designed to prevent wheelchair from rolling off platform and to provide grab bar for occupant.

2.4 FINISHES

A. General: Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal products” for recommendations relative to application and designations of finishes.


PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

   1. Enclose wiring within housings of units or building construction. Do not use conduit exposed to view in finished spaces.

B. Alignment: Coordinate runway gates with platforms travel and positioning, for accurate alignment and minimum clearance between platforms, runway gates, sills, and gate frames.

C. Position sills accurately, raised slightly above adjoining floor surfaces to minimize intrusion of dirt and spillage into runway. Fill space under sills solidly with non-shrink, non-metallic grout.

D. Adjust stops for accurate leveling at each landing, within specified tolerances.
1. Leveling Tolerance: \( \frac{1}{4} \) inch (6 mm) up or down, regardless of load and direction of travel.

E. Lubricate operating parts of lift, including drive mechanism, guide rails, gates, safety devices, and hardware.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: Upon normal completion of each lift installation, and before permitting the use of lifts, perform acceptance tests as required and recommended by the “Code” and by authorities having jurisdiction.

B. In addition to above testing, test operate lift continuously between lowest and highest landings served, lifting full-rated capacity load for a minimum period of 30-minutes. Readjust stops and other devices and signal equipment for accurate landings and operation of system.

3.3 DEMONSTRATION

A. Instruct University’s maintenance personnel in the proper use, operation, and maintenance of lifts. Review emergency provisions, including access and procedures to be followed in checking for sources of operational failures or malfunctions. Confer with University on requirements for a complete maintenance program.

B. Check each lift operation with University’s maintenance personnel present before time of Substantial Completion. Determine that control system, operating components, and safety devices are functioning properly.

END OF SECTION
SECTION 15000

MECHANICAL NARRATIVE

1.1 CODES AND STANDARDS

A. Information contained in this module is intended to set the minimum GSU design requirements and is not intended to provide complete design solutions to project specific situations.

B. Comply with the more stringent of governing laws, applicable local codes and regulations, or the GSU Facilities Design Criteria and Standards.

C. Refer conflicts between design standards to the appropriate GSU Project Manager for resolution.

D. All mechanical systems shall comply with the current Edition of the following Codes and Standards, but not be limited to:

2. Mechanical: International Mechanical Code
4. Georgia State Energy Code
5. National Fire Protection Association (NFPA)
6. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
7. Loss Prevention Underwriter: Factory Mutual Insurers
8. Safety & Health: U.S. Occupational Safety and Hazard Association (OSHA)
9. Equipment Installation ANSI B9.1
10. American Industrial Hygiene Association (AIHA) American National Standard for Laboratory Ventilation ANSI/AIHA Z9.5
13. American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Standards

1.2 DESIGN CONDITIONS:


1. Summer design conditions shall be as indicated under the 1% Design Dry-Bulb and Mean Coincident Wet-Bulb column for 94°F DB / 74°F WB.
2. Winter design conditions shall be as indicated under the 99% Design Dry-Bulb column for 17°F.
3. Cooling Tower design condition selection shall be as indicated under the 1% Design Wet-Bulb column for 77°F.

B. Summer inside design conditions shall be as follows:
1. All occupied areas at 75°F DB and 50% RH (Relative Humidity), unless noted otherwise. {Unoccupied 85°F DB (uncontrolled RH)}
2. Kitchens at 80°F DB and 60% RH
3. Electrical equipment rooms at 80°F DB (uncontrolled RH)
4. Computer rooms at 72°F DB and 50% RH (maximum)
5. Voice and Data Equipment rooms at 75°F DB and 50% RH (maximum)
6. Elevator Machine Rooms at 75°F DB and 50% RH (maximum) or per Manufacturer’s recommendations.
7. Swimming Pool Equipment Room and Hot Tub Equipment Room at 85°F D

C. Winter inside design condition shall be 70°F for occupied spaces and 65°F(min.) for unoccupied spaces, unless noted otherwise.

1.3 DESIGN CRITERIA:

A. The Boiler Room shall be provided with adequate outside air for combustion and ventilation of all equipment located in the room. Boiler room shall have a continuous air barrier separating it from the rest of the building and shall be positive or neutral pressure relative to outside pressure.

B. Block load heat gain calculations for cooling load estimates shall be based upon, but not necessarily limited to the following:
2. Heat gains from internal sources (people, appliances, lighting and receptacle) shall be defined and used in heat gain calculations.
3. Heat rejected to space by air cooled refrigeration equipment (ice machines, soda machines, etc…) shall be based upon total heat release of such equipment.
4. Central cooling generation equipment diversification shall be accounted for in the load calculation program through the use of 24-hour schedules for transmission, solar heat gain, occupancy, outside air ventilation, receptacle and lighting load profiles.

C. Heat loss calculations for heating load estimates shall be based upon, but not limited to the following:
1. Heating all outside air to a minimum of 65°F.
2. Heat required for domestic hot water, if not provided by a separate source.
3. Heat loss through walls, roof, floors and windows.
5. Pre-heat coils at central station air handling units for freeze protection.
6. Re-heat coils on all air handling units where 50% RH (Relative Humidity) maximums are required.
7. Calculations for individual spaces shall be based on actual “U” values, glazing solar heat gain coefficient (SHGC) and full occupancy. Calculations for individual spaces shall not credit interior heat gains from people, lights and appliances.

1.4 OUTSIDE AIR VENTILATION REQUIREMENTS


END OF SECTION
SECTION 15010

MECHANICAL GENERAL

1.1 Standardize equipment and materials with existing when possible/applicable.

1.2 Provide ample access to equipment for maintenance.

1.3 Mechanical equipment labeling:

   A. Format: XXX-XXX-XXX-XXX (University Building Number – Floor Number – Room Number – Equipment identification from design/construction documents (Example: ALC–FLR05-MECH.RM.560-AHU1)

   B. Equipment such as VAV Terminal Units should be identified with Room number where T'stat (Thermostat) is located.

1.4 Pipe identification required for all systems (Use Georgia State University’s standard specification for this item).

1.5 Provide Bakelite nameplates on all equipment, motor starters, remote push button stations, insertion type thermostats, remote bulb thermometers, filter gauges, pump pressure gauges, fans, pumps, panel mounted controls and manual damper operators, multi-zone damper sections by room number, room designation, zone number, etc.

1.6 Specify bound (1-1/2” min. to 3” max. ring binders) Operation and Maintenance Manuals (3 copies). Provide specific maintenance data, including replacement parts list for all equipment, and framed control diagrams/control sequences on appropriate equipment. Specify computer (Auto CAD) file for control diagrams. Specify contractor training for University maintenance personnel on all systems after submittal of O & M manuals. (One copy of electronic media for all O&M, TAB,COMMISSIONING, Approved Submittals & PDF version of as-built drawing).

1.7 Add a general note to all MEP drawings stating that all equipment, piping, conduit, etc. within a renovated space, which is abandoned, shall be removed.

1.8 Specify energy efficient equipment.

1.9 Specify only chilled water coil AHU system only when chilled water available. Only special application where chilled water system is not available or cost prohibitive then DX coil AHU may be considered for smaller then 5 ton systems.

1.10 All refrigeration equipment shall use 134A refrigerant only, except as specific project would require otherwise for good engineering practice.

1.11 All HVAC air and water systems require a certified Test and Balance report.
1.12 Equipment Redundancy and spare capacity: Generally, because of cost control, redundancy shall be mandated only in case of critical systems and/or equipment, such as condensate (steam) return units, sewage ejectors, submersible sump pumps, chilled water pumps, primary chilled water pumps, secondary chilled water pumps, condenser water pumps, primary hot water pumps, and control air compressor.

1.13 Specify Re-heat coils on all air handling units where RH (Relative Humidity) maximums are to be controlled.
SECTION 15050

BASIC MATERIALS AND METHODS

1.1 Provide isolation valves on pumps, chillers, coils, pipe risers, etc. Provide a balancing valve separate from the isolation valve. Provide strainers or suction diffusers at all pumps.

1.2 Use only sil-phos solder on copper chilled and hot water lines (No 95-5).

1.3 Provide automatic air vents at high places in water lines and at top of coils. Pipe vent drain line to hub or floor drains, preferably in mechanical spaces. Provide a means of draining any piping system completely. Provide 4-inch air gap above hub or floor drains for sight inspection of air vent failure.

1.4 All chilled water coils shall have ports and valves to support temperature and pressure difference measurement.

1.5 Valves shall be single domestic manufacturer.

1.6 Provide vibration isolation for equipment where needed.

1.7 Provide equipment bases and housekeeping pads.

1.8 All-thread nipples 1-1/2" and smaller in diameter, are prohibited. Nipples attached to larger pipes shall be Schedule 80 attached with the use of threadolets or weldolets.

1.9 All elbows shall be long radius unless otherwise noted.

1.10 Branch lines from piping mains should come off the top half of the main pipe.

1.11 Mitered fittings and tapped pipes are not allowed.

1.12 Provide unions in piping to all equipment and specialties to permit removal for service; union shall be metal seat type. Provide insulating unions where needed. Dissimilar metals, i.e. copper and steel, shall not be installed to allow direct contact between the metals. Provide dielectric connections. The designer shall minimize the quantity of dielectric unions. When used, unions shall be located in accessible locations for ease of maintenance.

1.13 Reducers in piping shall be eccentric type where grading is specified, (reducers shall be used to change pipe size).

1.14 Relief valves or devices discharge piping shall be piped to a drain.

1.15 Boilers and cooling tower make up water supplies shall have slow acting valves to prevent water hammer.

END OF SECTION
SECTION 15250
MECHANICAL & PLUMBING INSULATION

1.1 DUCTWORK:

A. Indicate duct sizes by “clear inside dimensions”. Do not use internal duct liner with high-pressure systems.
B. Provide extra duct insulation in attic spaces.
C. Specify Stainless Steel wire wrapping of duct external insulation.
D. Duct liner: No duct liner with fiberglass insulation allowed, except for sound attenuation. Use either closed cell foam insulation or mat-coating with an EPA registered anti-microbial coating to prevent fungal and bacterial growth.
E. Use 1-1/2” thick fiberglass exterior insulation with vapor barrier. Cover all joints, rips, tears, punctures, and breaks in vapor barrier jacket with 4” wide woven glass fabric tape embedded in vapor barrier, fire resistant adhesive, such as Foster 20-80 vapor barrier. Use of pressure sensitive tape is not acceptable.
F. All supply and return ductwork must be insulated with a minimum value of R-4.2.

1.2 CHILLED WATER PIPING:

A. All chilled water piping shall be insulated so as to prevent moisture condensation on exterior surfaces. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.
B. Above ground chilled water piping shall be insulated with foam glass pipe insulation. On pipe sizes smaller than 6”, specify 1-1/2” thick minimum. On pipe sizes larger than 6”, specify 2” thick minimum.
C. Below ground chilled water piping shall be insulated with 2” thick minimum foam glass pipe insulation.
D. All chilled water piping run-outs for gauges, thermometers, automatic air vents, drains, etc. shall be insulated and sealed with rubber insulating material.

1.3 CONDENSER WATER PIPING:

A. All condenser water piping shall be insulated so as to prevent moisture condensation on exterior surfaces. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.
B. Above ground condenser water piping shall be insulated with foam glass pipe insulation. On pipe sizes smaller than 6”, specify 1-1/2” thick minimum. On pipe sizes larger than 6”, specify 2” thick minimum.
C. Below ground condenser water piping shall be insulated with 2” thick minimum foam glass pipe insulation.
D. All condenser water piping run-outs for gauges, thermometers, automatic air vents, drains, etc. shall be insulated and sealed with rubber insulating material.
1.4 STEAM & CONDENSATE PIPING:

A. Above ground steam and condensate piping shall be insulated with calcium Silicate piping insulation. Steam piping insulation shall be a minimum of 3” thick and condensate piping shall be a minimum of 2” thick.

B. Below ground steam and condensate piping shall be either pre-insulated calcium Silicate or foam glass pipe insulation wrapped with glass fabric cloth and proper mastic. Steam piping insulation shall be a minimum of 3” thick and condensate piping shall be a minimum of 2” thick.

C. Piping run-outs up to 12 feet in length and 2 inches in diameter, may have insulation thickness ½” less than indicated above.

D. Attachments for below grade insulation shall be stainless steel wiring, bands, or 16 gauge copper wire on 6-inch centers.

1.5 HEATING HOT WATER PIPING:

A. All heating hot water supply and return piping shall be insulated with fiberglass pipe insulation so as to prevent moisture condensation on exterior surfaces. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.

1.6 DOMESTIC WATER PIPING:

A. All domestic water piping shall be insulated with fiberglass pipe insulation so as to prevent moisture condensation on exterior surfaces. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.

B. Specify pre-molded insulation under lavatories to meet ADA requirements.

1.7 PROCESS WATER PIPING:

A. All process water piping shall be insulated so as to prevent moisture condensation on exterior surfaces. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.

1.8 EQUIPMENT INSULATION:

A. Chilled Water Equipment: All chilled water equipment shall be insulated with foam glass or fiberglass insulation so as to prevent moisture condensation on exterior surfaces. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.

B. Air Handling Equipment: Provide fiberglass insulation complying with NFPA 90A, a minimum of 1-inch thick and 1- 1/2 pounds per cubic foot density.

END OF SECTION
SECTION 15300

FIRE PROTECTION

1.1 Provide fire sprinkler system in accordance with NFPA 13 for all new buildings unless directed otherwise by University Project Manager. Provide sprinkler system in those renovation/repair projects wherever necessary to meet applicable codes or where requested by University Project Manager.

1.2 All fire sprinkler system design drawings must be sealed by a Georgia registered Professional Engineer and must be approved by the State Fire Marshall's Office.

1.3 Contract documents shall require the fire protection Contractor to submit sprinkler shop drawings and hydraulic calculations directly to the State Fire Marshall for approval.

1.4 Contractor to coordinate with GSU Facilities Maintenance for fire alarm shut-down.

END OF SECTION
SECTION 15400

PLUMBING

1.1 Use Sloan “Royal” or “Crown” flush valves. Zum “Sloan Clone” would be 3rd choice. Provide hard wired power for faucets whenever possible. Use 0.125 gallon per flush for urinals. Dual flush valves for water closets are preferred.

1.2 Countertop lavatories are preferred in restrooms with undermount sinks. Under counter sinks shall use white vitreous china, based on Kohler D-2211. Lavatories designed for ADA use shall be mounted at the designated height by the Americans with Disabilities Act, Georgia Amendments.

1.3 Wall-mounted lavatories shall use white vitreous china, based on Kohler K-2805B. Lavatories designed for ADA use shall be mounted at the designated height by the Americans with Disabilities Act, Georgia Amendments.

1.4 Use hands free faucets. Technical Concepts TC 500484 Faucet with “surround sensor” technology should be basis of design. Provide hard wired power for faucets whenever possible.

1.5 Use Spence Engineering Company steam pressure reducing valves with low-pressure relief valve vented to outside.

1.6 Use American Standard or Kohler plumbing fixtures and trim. Other brands may be used with University’s express approval. Use wall-hung water closets and urinals where feasible.

1.7 Provide hose bib in restrooms with security key for operation.

1.8 Provide hose bib in laboratories wherever Janitor’s closet is not in vicinity.

1.9 Design all new restrooms and emergency showers to have floor drain to protect the building from valve failure and improve housekeeping maintenance. Make trap primers accessible for repair.

1.10 Use Oasis water coolers. Second choice: Sunroc. (R-134a, not R-12)

1.11 Do not permit use of galvanized water pipe.

1.12 Provide shutoff valves on utilities outside building and accessible isolation valves at each floor or restroom.

1.13 Include insulation of rainwater drainage system horizontal runs from roof drain (interior) leaders. Also insulate vertical runs in return air plenums.

1.14 Provide air chambers or shock absorbers at plumbing fixtures.
1.15 Provide domestic water supply (hose bib) at cooling towers and in mechanical rooms, including AHU rooms, for maintenance purposes.

1.16 Boilers and cooling tower make up water supplies shall have slow acting valves to prevent water hammer.

1.17 Process Water Piping: Deionized water and Reverse Osmosis piping shall be polyvinylidene fluoride (PVDF) resin with thermal fusion. Faucets need to have non-conductive type material.

1.18 Provide shut off valves for all services into laboratory spaces to allow for single lab to be isolated. Mechanical piping identification shall comply with ANSI A13.1.

1.19 Domestic hot water shall be a re-circulating type system.

1.20 For laboratory designs, drain from laboratory sinks must be separately plumbed to a holding tank for pre-treatment prior to release into city sewer system.

1.21 Provide floor drains on all new restroom construction.

1.22 Install isolation valves to every floor of all risers.

END OF SECTION
SECTION 15500

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

1.1 Use cast iron reservoir duplex condensate return pumps with SS impeller and stem. (Specification standard manufacturer: Hoffman; second choice: Dunham-Bush.) Vent these to the outside.

1.2 For steam boilers, use a Pulsatron Series E+ or equivalent metering pump to feed chemicals.


1.4 Steam traps shall be readily available for ease of maintenance. The boiler and steam distribution system shall be complete with but not limited to the following: Isolation valves, Control valves, Boiler blow down cooler and piping, Flash tank, make up water treatment system, Chemical feeder, Pressure reducing stations, Deaerator, Flue gas monitoring, condensate tank,

1.5 Condenser water makeup lines shall have meters acceptable to City of Atlanta Water System for recording water used for evaporation. Meters shall be located to allow easy reading without the use of a ladder. Boilers shall have meter to allow recording makeup water use.

1.6 Provide Chemical Controllers, feed equipment, and coupon racks (see standard detail) for hot water, chilled water, condenser water and steam systems. Closed chilled and hot water systems shall have one shot feeders and sampling port location below face level. Pumps shall be positive displacement pumps equivalent to Pulsatron pumps. Controllers shall be electronic control type. Conductivity controllers shall be Pulsatron MCT310. Condenser water blowdown valves shall be stainless steel ball valve driven by normally closed spring return type motorized actuators.

1.7 Require cleaning of all piping systems prior to initial operation including chilled water, condenser water, hot water, steam, domestic and fire protection systems.

1.8 Provide all water treatment equipment required to deliver chemicals to systems at completion of construction, i.e. shot feeders, blowdown controls, chemical pumps, and meters. Also, provide test equipment for operating personnel.

1.9 Hot water and steam condensate pumps shall have stainless steel shafts and impellers.

1.10 Automatic (boiler) surface blowdowns shall have steel trimmed motorized ball valves.

1.11 Use Grundfos 1/25 and 1/6 HP circulating pumps. These are water cooled and water lubricated.

1.12 Use Aurora turbine type boiler feed pumps (in duplex) with SS impeller and stem.
1.13 Specify manufactured equipment curbs (Pate or Thycurb) for all roof mounted equipment. Do not allow equipment to be mounted on pressure treated wood.

END OF SECTION
1.1 Hot water boilers are preferred over steam for 40 HP and higher. If a steam boiler is used, locate make up water feed in the condensate return systems; not directly into the boiler. Boiler systems should also contain de-aerator.

1.2 Use Cleaver Brooks fire tube boilers for steam 40 HP and higher. Second choice: Kewanee Boiler. Acceptable alternate manufacturers include Burnham, Hurst and Superior.

1.3 Boilers shall be designed in accordance with the American Gas Association; manufactured in accordance with the ASME Power Boiler Code, and shall meet the State Boiler code.

1.4 Hydrostatically test the boilers and piping in accordance with the ASME Boiler and Pressure Vessel Code.

1.5 Fire tube boilers are preferred while condensing boilers shall be used for buildings that utilize hot water re-heat.

1.6 Allow space around boilers for annual preventive maintenance and adequate access to boiler components.

1.7 Provide emergency shutdown button switch for each boiler. Switch shall be maintained and tested, mushroom type at mechanical room entrance.

1.8 Permits for boilers, and pressure vessels, new or relocated, shall be included in the project costs.

1.9 Building heat generation systems shall include all isolation valves and steam piping and fittings, steam specialties, control valves, pumps and shell and tube heat exchangers.

1.10 Boiler fuel selection and system design will be in accordance with the ASHRAE and NFPA standards. Consult with GSU Facilities Maintenance on fuel type. Gas vs fuel oil has air emissions issues that the GSU environmental group has to be involved with.

1.11 Boilers that serve Vivarium space heating, cage washer and steam for autoclaves shall be on emergency power.

1.12 There shall be emission standards for any new boiler according to Georgia Quality Nitrogen Oxide Emission Compliance.

1.13 Design steam distribution and condensate piping with loops, bends, and offsets to allow for thermal expansion and keep stresses within allowable limits of the piping material.
1.14 For domestic water heating equipment, use Ray-Pak, 96% thermal efficiency hot water generation equipment, or equivalent A.O. Smith Legend. Lochinvar New Generation also acceptable. Use high efficiency condensing boilers for domestic hot water heating system. Aerco and Cleaver Brooks condensing hot water boilers are preferable.

1.15 Use 96% thermal efficiency combustion equipment wherever available.

1.16 It is preferable to use heating hot water coil system instead of heating steam coil system.

1.17 Domestic hot water shall be a recirculating type system.

1.18 Use low NOX (Nitrogen Oxide) burners for gas firing boilers.

END OF SECTION
SECTION 15750

HEAT TRANSFER

1.1 Design steam heat exchangers (that use a modulating control valve) to have gravity or a pumped condensate return system to save wear and tear on the heat exchanger.

END OF SECTION
SECTION 15850

AIR HANDLING UNITS

1.1 Evaporator coils/condensate drains in ceilings shall have emergency drip pans and high level shut off. Drip pans shall be anti-corrosion coated or stainless steel. Drip pan overflow drain line should discharge into readily observable space (such as public corridor).

1.2 All condensate drain pans shall be coated with rust preventative paint or be stainless steel, and shall be slopped properly to drain to prevent the accumulation of condensate in the drain pan.

1.3 Statically and dynamically balance fans at the factory.

1.4 Provide all required clearances and maintenance access.

1.5 Coil casings shall be stainless steel construction.

1.6 Cooling coils shall be provided with maximum of 12 fins per inch.

1.7 Each cooling coil shall have a drain pan.

1.8 Intermediate drain pans shall be installed on multiple coil section

1.9 Air Handling Units shall be double wall construction.

1.10 Do not locate any air handler above the ceiling without prior approval.

1.11 Use of fan coil units is discouraged and shall be used in limited scope. Do not locate any fan coil unit above a ceiling without prior approval.

1.12 For energy recovery equipment, locate all maintenance parts (belts, motors, bearings etc.) outside of contaminated air stream.

1.13 All Air Handling Units with chilled water coils shall have minimal preheat coil for freeze protection and reheat coils for primary heat and dehumidification.

1.14 All Air Handling Units with DX cooling coils shall have reheat coils for primary heat and dehumidification. The condensing unit shall have hi/low cut-off and crack case heaters an analog fan controls for head pressure control.

END OF SECTION
SECTION 15880

AIR DISTRIBUTION

1.1 Variable Air Volume units, Powered Induction Units and other terminal HVAC equipment shall have 36 inches minimum side clearance for maintenance access. VAV with VAV Reheat terminal units shall be used for new VAV system installations. Preferred manufacturers are Price, Titus, Trane, or approved equal. Metalaire is not recommended.

1.2 Provide access panels for fire damper maintenance. Panels shall comply with SMACNA Standards.

1.3 Allow flexible duct runs no longer than 5 feet with only one 90-degree bend.

1.4 Air filters shall comply with the newest IAQ Standards (normally pre-filter with high efficiency filter behind it or electrostatic filtration on larger systems. Minimum 60% for all systems.

1.5 All fume hood ducts shall be type 316 stainless steel.

1.6 Provide access to sheet metal accessories, air dampers, splitter dampers, etc. All access panels shall be 24 inch square. 18-inch panels are not acceptable.

1.7 Provide balancing dampers on all branch lines.

1.8 Air flow measuring stations shall use electronic type sensors with differential pressure or pitot tube technology.

1.9 Diffusers, Registers, and Grilles shall be of corrosion resistant construction of aluminum or stainless steel.

1.10 Provide access door for maintenance of all terminal units.

END OF SECTION
SECTION 15900

LABORATORY FUME HOODS – MECHANICAL SYSTEMS

1.1 Laboratory fume hood design shall comply with the latest edition of the Board of Regents of The University System of Georgia Fume Hood Design Criteria.

1.2 Exhaust system design shall comply with ANSI/AIHA Z9.5 and IBC codes. All electrical outlets inside fume hood shall be explosion proof.

1.3 All laboratory fume hoods shall comply with the latest edition of SEFA (Scientific Equipment and Furniture Association) Recommended Practices for Laboratory Fume Hoods.

1.4 All laboratory control VAV terminal controllers shall use high accuracy electronic type flow sensing devices.

1.5 Monitoring devices: All hoods of any type shall have a flow indicator or indicator controller. Indicating light alone is not approved.

1.6 Do not use centralized vacuum pumps.

END OF SECTION
SECTION 15940

BUILDING AUTOMATION SYSTEMS (BAS)

1.1 General: All Georgia State University Buildings HVAC systems shall be controlled by Direct Digital Control (DDC) systems. If the project involves minor modification or retrofit of HVAC system then the existing building DDC control system may be re-used. If the project involves modification of a whole floor or construction of a new building then follow the guideline indicated in the following section 2.0.

1.2 System: The building Automation System (BAS) contractor shall furnish and install a fully integrated direct digital control (DDC) system which is software based on existing server/client architecture designed around the open standards of web technology. The BAS servers shall communicate using Internet Protocol such as ASHRAE’s BACnet/IP or Ethernet IP protocol. The server shall be accessed using standard web browser like Netscape or Internet Explorer over Internet or Intranet or dedicated client computer. The BAS shall use twisted pair copper conductor within the building to communicate in between controllers. The BAS server shall be located on the 5th floor of Urban Life building room 502 campus EMS control room. The BAS shall use campus secure building systems 100Base-T Ethernet network to communicate in between BAS server and building controllers. The contractor shall provide all hardware required for data tunneling in between BAS server and building controllers. All controllers associated to a system shall design to function as stand alone. Building Level Network (BLN) with peer-to-peer commutation.

1.3 Approved Manufacturers: Johnson Controls and Siemens Building Automation.

1.4 Design Doc.: Provide all physical input/output summaries for points on drawings. Provide sequence of operation on drawings referring all input/output points in summary list. During design 60% review submit conceptual sequence of operation and point summary involved in the project. Provide flow diagram for hydronic systems on drawing.

1.5 Interoperability: If the project involves a GSU building which has existing Siemens Apogee 600 system, a new control system may use the existing BAS system input/output point value over BACnet protocol. The new system shall communicate as peer-to-peer with the existing building controllers and maintain building stand alone capabilities. The BAS contractor shall contact Siemens Building Technologies Landis Division in Atlanta to get necessary information or co-ordination. The same should occur if Siemens become the lowest bidder and needed information from DDC system manufactured by other than Siemens. No gateways or protocol converters allowed.

1.6 Products:

A. Major HVAC equipment like AHU, Chiller, Boiler, Cooling Tower, Pump shall be controlled by DDC controllers which shall be stand alone, multitasking, multi-user, real-time digital control processors modular type. DDC controllers shall communicate peer-to-peer within network level. In the event of the loss of normal power, there shall be orderly shutdown of DDC controller to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller
configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum 48 hours. Upon restoration of normal power, the DDC controller shall automatically resume full operation without manual intervention. If any reason DDC controller loose memory the system shall automatically reload the DDC controller from database server via network. The DDC controller shall have an additional RS-232C port to communicate via telephone line.

B. VAV, FCU, PIU, Fume hood monitors may use canned programmed controllers.

C. Application specific controllers (ASC) can be used to provide operating equipment information over RS-485 serial communication for VFD, Roof top units, packaged AHUs, chillers, boilers. Physical output and input from primary DDC controllers indicated in sec.6.0 (a) shall be used to control all HVAC equipment.

D. All room sensors shall have LCD display for temperature and local set point adjustment knob. The local adjustment capability shall be locked by system software minimum 68°F to maximum 74°F otherwise specified for special range.

E. All immersion pipe sensors and duct sensors shall be RTD, PT100 or PT1000 type. No thermister type sensor allowed for fluid temperature measurement or duct temperature measurement. Outside air and AHU return air relative humidity measurement sensors shall be VAISALA HUMICAP model.

F. All static pressure sensor and relative humidity sensors shall be analytical grade solid state with an accuracy of ±/ - 1.0%. Use VAISALA only for outside air and duct mounted relative humidity sensors.

G. All damper actuator and valve actuators shall be nonstall electronic types. Only special circumstances pneumatic actuators may be used.

H. Every coil shall have a temperature sensor including terminal boxes with reheat and multi-zone dampers. Terminal boxes with electric re-heat shall have a temperature sensor at the discharge airside.

I. All status for current drawing equipment shall use current transformer type sensor. No dry contact from starter allowed using for proof.

J. Chillers, Boilers, Roof top package units shall have one digital output for enable, one digital input for operating status and one digital input for general alarm status. If LAN compatible then BAS contractor shall place unit on Serial bus.

K. If AHU designed for airside economizer then provide return air temperature sensor and relative humidity sensor. The system shall use enthalpy algorithm to measure return air BTU and compare with outside air BTU to use the lowest energy required to cool the source of air. Building systems shall switch to airside economizer mode base on adjustable outside air-dry bulb temperature and locked by adjustable high limit for outside air relative humidity.

L. If waterside economizer used for building systems then outside air wet bulb temperature shall be used to switch into waterside economizer mode. All cooling
tower basin temperature set point shall maintain based on adjustable outside air wet bulb temperature.

M. All laboratory control use room pressurization monitor and room pressurization controller. Room pressure monitor and controller shall be tied with DDC network to monitor and control lab differential pressure compared to adjacent space. Lab fume hoods shall have fume hood controller/monitor and monitors shall be tied with DDC control network for remote monitoring. All fume hood shall have local sash override alarm and high /low flow audible alarm.

N. All secondary chilled water system shall have supply and return chilled water temperature sensor and a flow sensor. DDC software shall calculate the load measuring chilled water flow and temperature difference provide the load in Tons.

1.7 Graphic standard: The control vendor shall provide graphics as close possible as existing building graphics are now used. It is recommended that control vendor review the existing graphics prior to develop new graphics for any new projects.

A. If renovation project involves in existing building then the existing floor graphics shall be modified to reflect the modification. Each floor shall have its own floor graphics converted from existing building Auto CAD file. All Auto CAD files can be arrange by GSU project manager to provide control vendor.

B. All zones shall be colored differently to identify the zone boundary limits. Use construction drawing to identify zones. Show terminal box locations and sensor locations for each zone.

C. All HVAC equipment graphics shall be developed using clip art provided by software manufacturer. Do not use Auto CAD drawing to draw equipment graphics. The control vendor encouraged to copy existing equipment graphics if applicable.

D. Provide all links for related graphics. Floor graphics shall link to related AHU graphics. Room temperature shall link with associated terminal box or multizone AHU. All floor and equipment shall link with the parent building profile link. Usually building profile graphics developed using building digital photograph. All links shall follow its source as for example floor zone links to terminal unit of zone damper, terminal unit links to corresponding AHU, AHU links to secondary chilled water pumps, boiler plant and chilled water plant.

E. All control logic shall request same as graphic links, like zone temperature sensor shall request heat or cooling from corresponding terminal unit, terminal unit shall request its source AHU, AHU shall request its source chilled water pump. Building load in Tons shall request chiller plant to produce chilled water. Same as building load and outside condition shall request for boiler plant for heat.

1.1 Work By Others:

A. Mechanical contractor installs all wells, valves, taps, dampers, flow stations, etc. furnished by BAS manufacturer.
B. Electrical Contractor provides:
   1. 120V power to all BAS an/or Temperature control panels
   2. Wiring of all power feeds through all disconnect starters to electrical motors
   3. Wiring of any remote start/stop switches and manual or automatic motor speed
      control devices not furnished by BAS manufacturer

1.8 Quality Assurance:

A. The BAS system shall be designed and installed, commissioned and serviced by
   manufacturer factory trained personnel.

B. Materials and equipment shall be the catalogued products of manufacturers regularly
   engaged in production and installation of automatic temperature control systems and
   shall be manufacturer’s latest standard design that complies with the specification
   requirements.

C. All electronic equipment shall conform to the requirements of FCC Regulation, Part
   15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so
   labeled.

1.1 Submittals:

A. Specify for complete sets of documentation in the following phased delivery schedule:
   1. Valve and damper schedules
   2. Equipment data cut sheets
   3. System schematics, including:
      4. Sequence of operations
      5. Point names
      6. Point addresses
      7. Interface wiring diagrams
      8. Panel layouts.
      9. System riser diagrams
     10. Auto-CAD compatible as-built drawings

A. Specify for Upon project completion, submit operation and maintenance manuals,
    consisting of the following:
    1. Index sheet, listing contents in alphabetical order
    2. Manufacturer’s equipment parts list of all functional components of the system,
       Auto-CAD disk of system schematics, including wiring diagrams
    3. Description of sequence of operations
    4. As-Built interconnection wiring diagrams
    5. Operator’s Manual
    6. Trunk cable schematic showing remote electronic panel locations, and all trunk
       data
    7. List of connected data points, including panels to which they are connected
       and input device (ionization detector, thermostat, etc.)
    8. Conduit routing diagrams

1.9 Warranty:
A. Specify for BAS contractor to provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after beneficial use.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission, equipment and all sensors and control devices.

C. The on-line support services shall allow the local BAS subcontractor temporary use of campus network access using VPN remote access to monitor and control the facility’s building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

D. If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility. If the problem cannot be resolved with on-line support services, the BAS subcontractor shall dispatch the appropriate personnel to the job site to resolve the problem within 3 hours of the time that the problem is reported.

1.10 DDC Controller:

A. DDC Controllers shall be stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point list.

A. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:
   1. Control processes
   2. Energy management applications
   3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
   4. Historical/trend data for points specified
   5. Maintenance support applications
   6. Custom processes
   7. Operator I/O
   8. Dial-up communications
   9. Manual override monitoring

B. Each DDC Controller shall support any combination of industry standard inputs and outputs.

C. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

A. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local,
point discrete, on-board hand/off/auto operator override switches for digital control
type points and gradual switches for analog control type points.

1. Switches shall be mounted either within the DDC Controllers key-accessed
   enclosure, or externally mounted with each switch keyed to prevent
   unauthorized overrides.
2. DDC Controllers shall monitor the status of all overrides and inform the
   operator that automatic control has been inhibited. DDC Controllers shall also
   collect override activity information for reports.

D. Each DDC Controller shall continuously perform self-diagnostics, communication
diagnosis and diagnosis of all panel components. The DDC Controller shall provide
both local and remote annunciation of any detected component failures, low battery
conditions or repeated failure to establish communication.

E. Isolation shall be provided at all peer-to-peer network terminations, as well as all field
point terminations to suppress induced voltage transients consistent with IEEE

F. In the event of the loss of normal power, there shall be an orderly shutdown of all
DDC Controllers to prevent the loss of database or operating system software.
Non-volatile memory shall be incorporated for all critical controller configuration data
and battery backup shall be provided to support the real-time clock and all volatile
memory for a minimum of 48 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically
   resume full operation without manual intervention.
2. Should DDC Controller memory be lost for any reason, the user shall have the
   capability of reloading the DDC Controller via the local RS-232C port, via
   campus Ethernet from a network workstation PC.

G. Provide a separate DDC Controller for each AHU or other HVAC system as indicated
in Section 3.02. It is intended that each unique system be provided with its own point
resident DDC Controller.

1.11 DDC Controller Resident Software Features:

A. General:
   1. The software programs specified in this Section shall be provided as an
      integral part of DDC Controllers and shall not be dependent upon any higher-
      level computer for execution.

B. Control Software Description:
   1. The DDC Controllers shall have the ability to perform the following pre-tested
      control algorithms:
   2. Two-position control
   3. Proportional control
   4. Proportional plus integral control
   5. Proportional, integral, plus derivative control
   6. Automatic tuning of control loops
A. DDC Controllers shall have the ability to perform any or all the following energy management routines:
   1. Time-of-day scheduling
   2. Calendar-based scheduling
   3. Holiday scheduling
   4. Temporary schedule overrides
   5. Start-Stop Time Optimization
   6. Automatic Daylight Savings Time Switchover
   7. Night setback control
   8. Enthalpy switchover (economizer)
   9. Peak demand limiting
   10. Temperature-compensated duty cycling

C. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
   1. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network.
   2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a remote device such as a printer or text message to cell phone and radio.

D. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at the PC workstation, local I/O device or communications with other panels on the network.
   1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
   2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
   3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs.
   4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character or more alarm message to more fully describe the alarm condition or direct operator response.
E. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.

1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of data samples. All trend data shall be available for use in 3rd party personal computer applications.

2. DDC Controllers shall also provide high-resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
   a. Loop tuning shall be capable of being initiated either locally at the DDC Controller, from a network workstation or remotely using dial-in modems. For all loop-tuning functions, access shall be limited to authorized personnel through password protection.

F. DDC Controllers shall automatically accumulate and store run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O summary.

1.12 Application Specific Controllers (ASC)

A. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through LAN Device Networks.

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, and real-time digital control processor. Provide the following types of ASCs as a minimum:
   1. Terminal Equipment Controllers

C. Terminal Equipment Controllers:
   1. Provide for control of each piece of equipment, including, but not limited to, the following:
      a. Variable Air Volume (VAV) boxes
      b. Constant Air Volume (CAV) boxes
      c. Dual Duct Terminal Boxes
      d. Unit Conditioners
      e. Heat Pumps
      f. Unit Ventilators
      g. Room Pressurization

D. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 PSI pneumatic, allowing for interface to a variety of
modulating actuators. Terminal controllers utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide DDC Controllers or other ASCs with industry standard outputs for control of all terminal equipment including pneumatic actuation.

E. Connection of a POT to a DDC or ASC Controller shall not interrupt nor interfere with normal network operation in any way, prevent alarms from being transmitted or preclude centrally initiated commands and system modification.

F. Portable operator terminal access to controller shall be password-controlled.

1.13 Workstation Operator Interface:

A. Basic Interface Description

1. Operator workstation interface software shall minimize operator training through the use of English language prompting, English language point identification and industry standard PC application software. The software shall provide, as a minimum, the following functionality:
   a. Real-time graphical viewing and control of environment
   b. Scheduling and override of building operations
   c. Collection and analysis of historical data and dynamic data (trend plot)
   d. Definition and construction of dynamic color graphic displays
   e. Editing, programming, storage and downloading of controller databases
   f. Alarm reporting, routing, messaging, and acknowledgement

2. Provide a graphical user interface, which shall minimize the use of keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection.

3. The software shall provide a multi-tasking type environment that shall allow the user to run several applications simultaneously. These Windows applications shall run simultaneously with the BAS software.
   a. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via user-sized windows:
      1) Dynamic color graphics and graphic control
      2) Alarm management, routing to designated locations, and customized messages
      3) Week at a Glance Time-of-day scheduling
      4) Trend data definition and presentation
      5) Graphic definition and construction
      6) Program and point database editing on-line.
   b. If the software is unable to display several different types of displays at the same time.
   c. Report and alarm printing shall be accomplished via Windows program manager, allowing use of network printers.

4. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation
capabilities as deemed appropriate for each user, based upon an assigned password.

5. Reports shall be generated on demand or via pre-defined schedule and directed to CRT displays, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:
   a. A general listing of all or selected points in the network
   b. List of all points currently in alarm
   c. List of all points currently in override status
   d. List of all disabled points
   e. List of all points currently locked out
   f. List of user accounts and access levels
   g. List all weekly schedules
   h. List of holiday programming
   i. List of limits and deadbands
   j. Excel reports
   k. System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points
   l. List of programs

1. Scheduling and override: Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Schedules reside in both the PC workstation and DDC Controller to ensure time equipment scheduling when PC is off-line; PC is not required to execute time scheduling. Provide override access through menu selection or function key. Provide the following spreadsheet graphic types as a minimum:
   a. Weekly schedules
   b. Zone schedules, minimum of 200 unique zones
   c. Monthly calendars

2. Collection and Analysis of Historical Data
   a. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.
   b. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.
   c. Provide additional functionality that allows the user to view real-time trend data on trend graph displays. A minimum of six points may be
graphed, regardless of whether they have been predefined for trending. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take “snapshots” of screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed.

B. Dynamic Color Graphic Displays

1. Create Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems and hot water boiler systems, shall be provided by the BAS contractor as indicated in the point I/O summary of this specification to optimize system performance analysis and speed alarm recognition.

2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands. Graphics software shall permit the importing of AutoCAD or Bitmap drawings for use in the system.

3. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
   a. Analog bars in 3 sizes shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.
   b. Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
   c. Equipment state can be changed by clicking on the point block or graphic symbol and selecting the new state (on/off) or setpoint.

4. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.

5. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

6. Off the shelf graphic software shall be provided to allow the user to add, modify or delete system graphic displays.

7. A clipart library of HVAC and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams and laboratory symbols. The user shall have the ability to add custom symbols to the clipart library.

C. System Configuration & Definition

1. Network wide control strategies shall not be restricted to a single DDC Controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.

2. Provide automatic backup and restore of all DDC controller databases on the workstation hard disk. In addition, all database changes shall be performed.
while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller. Changes made at the DDC Controllers shall be automatically uploaded to the workstation, ensuring system continuity.

3. System configuration, programming, editing, graphics generation shall be performed on-line.

D. Alarm Management

1. Alarm Routing shall allow the user to send alarm notification to selected printers or PC location based on time of day, alarm severity, or point type.

2. Alarm Notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. These alarm icons shall be displayed when user is working in other Windows programs. The BAS alarm display screen shall be displayed when the user clicks on the alarm icon.

3. Alarm Display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message.

4. Alarm messages shall be customizable for each point to display detailed instructions to the user regarding actions to take in the event of an alarm.

1.14 Field Devices:

A. Temperature Sensors - with accuracy of + 0.5 deg F @ 77 deg F)

1. Digital room sensors shall have day / night override button, and setpoint slide adjustment override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment.

2. Built-in port allows connection of Portable operator terminal to query and modify operating parameters on room level sensor.

3. Room sensors shall have sensing accuracy of + 0.5 deg F, display accuracy and resolution shall be a minimum of + 1 deg F.

   a. Humidity Sensors - with accuracy of + 2% RH @ 77 deg F, range of 20% to 95% RH, including hysteresis, linearity, and repeatability
   b. Pressure Sensors – Setra
   c. Dampers, sized for specific application
   d. Damper Operators, sized for specific application
   e. Automatic Control Valves, sized for specific application
   f. Air Volume Measurement
   g. Smoke Detectors - BRK 120V ionization duct type
   h. Firestats - for applications less than 2000 CFM
   i. Low Temperature Detection Stat -
   j. Electric Thermostats
   k. Electronic-to-Pneumatic Transducers
   l. Differential Pressure Switch
   m. Solenoid Air Valves (EP)

   a. Pressure Electric Switch (PE)
   b. Instrument Air Supply
   c. Refrigerated Air Dryer
1.15 Project Management:

A. Specify to provide a designated project manager who will be responsible for the following:
   1. Construct and maintain project schedule
   2. On-site coordination with all applicable trades and subcontractors
   3. Authorized to accept and execute orders or instructions from owner/architect
   4. Attend project meetings as necessary to avoid conflicts and delays
   5. Make necessary field decisions relating to this scope of work
   6. Coordination/Single point of contact

1.16 Sequence of Operation:

A. Job specific - per job requirements

1.17 Point Schedule Matrix - I/O Summary:

A. Attach I/O summary

B. The contractor shall collaborate with the owner directly to determine the owner’s preference for naming conventions, etc. before entering the data into the system.

C. Mechanical equipment naming format: XXX- XXXXX-XXX-XXXXX Building Initial as per university building code – Floor Number – Room Number – Equipment ID from drawing. Example: ALC- FLR05- MECH.RM.560- AHU1

1.18 Start-Up and Commissioning:

A. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

B. Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

1.19 Existing Control Devices:

A. The bid for the control work shall be based on the premise that existing control devices are operational and are not in need of repair or replacement, unless otherwise noted.

B. This subcontractor shall notify the owner’s representative of existing control devices that need to be replaced or repaired that may be noted in the process of installation of the new work.
1.20 Training:

A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 3:30 PM weekdays.

B. Provide training for Owner’s designated operating personnel. Training shall include:
   1. Explanation of drawings, operations and maintenance manuals
   2. Walk-through of the job to locate control components
   3. Operator workstation and peripherals
   4. DDC controller and ASC operation/function
   5. Operator control functions including graphic generation and field panel programming
   6. Operation of portable operator’s terminal
   7. Explanation of adjustment, calibration and replacement procedures
   8. Student binder with training modules

C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If such training is required by the Owner, it will be contracted at a later date.

END OF SECTION
SECTION 15975

VARIABLE FREQUENCY DRIVE

PART 1 GENERAL

1.1 Section Includes
   A. Variable Frequency Drives (VFDs)

1.2 (This section not used)

1.3 References
   A. Standard 519-1992, IEEE Guide for Harmonic Content and Control
   B. Underwriters Laboratory Inc. UL508
   C. NEC
   D. NEMA, ICS 7.0, AC variable Frequency Drives

PART 2 PRODUCTS

2.1 Manufacturers
   A. Danfoss/Graham, ABB, Square D, Toshiba and Yasakawa/MagneTek.

2.2 General
   A. Furnish complete variable frequency drives as specified herein for the equipment scheduled to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA 1 enclosure, wall or floor mounted, UL labeled with output contactor, integral power disconnect with door interlock, completely factory-wired, ready for field connection of incoming and outgoing power and control signal, in compliance with NEMA ICS1-1993, NEMA ICS6-1993 and NEMA ICS7-1995. Provide NEMA12 enclosure for water proof outside installations.

   B. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to negate the need for motor de-rating.

      1. The VFD operator panel shall include digital display and keyboard for entry of set-up parameters, recall of faults from diagnostic module, display of current operating values of voltage and amperage, and speed indicator with 0-100% scale. Provide nameplate engraved with system identification and hand-off-automatic switch. The hand position shall start the drive, with a manual potentiometer or keypad entry for speed adjustment. In the automatic position, the drive shall be started and adjusted remotely.

      2. VFD shall design to operate at full load with ambient conditions between 40 deg. F and 104 deg. F, with capacity to handle 110% overload torque for 1 minute. When VFD enabled by remote controls, the drive shall start at zero speed and ramp to the current speed setting. Speed range shall be adjustable
between 0 and 66 Hz, with separately adjustable maximum and minimum speeds and adjustable rate of acceleration and de-acceleration. Provide at least 2 lockout speed ranges with adjustable minimum and maximum speed settings to prevent operation at driven equipment resonant vibration frequencies.

C. The VFD shall include a full-wave diode bridge rectifier and maintain a fundamental power factor in between 0.95 and 1.0 regardless of speed or load. The VFD shall have current limiting fuses or semi-conductor protection on the incoming line side. Speed regulation shall be within 3% accuracy.

D. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Local representative panel shop assembly for option panels is not acceptable. The appropriate UL stickers shall be applied to both the drive and option panel, in the case where these are not contained in one panel.

E. The VFD shall have a built in impedance reactor to minimize power line harmonics. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD). The VFD manufacturer shall provide calculations specific to this installation showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFD’s shall include a minimum of 5% impedance reactors.

F. The VFD’s full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

G. The VFD shall be able to provide full torque at any selected speed up to base speed to allow driving direct drive fans without de-rating.

H. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or de-accelerate to set point without safety tripping or component damage (flying start).

I. Input and output power circuit switching can be done without interlocks or damage to the VFD.

J. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage tripping. The number of restart attempts, trial time and time between attempts shall be programmable.

K. Protective Features:
   1. Class 20 I2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications.
   2. Protection against input transients DV/DT, 3% loss of AC line phase, short circuit DI/DT, ground fault, overvoltage, under-voltage, drive over
temperature, inverse time over current, phase sequence, phase loss and motor overtemperature. The VFD shall display all faults in plain English.

3. Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output with an input voltage as low as 150 volts for 208/230 volt units, and 285 volts for 460 volt units.

4. Drive shall have semi-conductor rated input fuses to protect power components.

5. Drive shall include a “signal loss detection” circuit to sense the loss of the control signal, and shall be programmable to react and continue to operate at the last commanded remote control signal in such instance and activate a remote alarm contact.

6. VFD shall be rated for 100,000 amp interrupting capacity (AIC).

7. Drive shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

8. Drive shall continue to operate without faulting until input voltage exceeds 300 volts on 208/230 volt drives, and 604 volts on 460 volt drives.

9. VFD shall be designed to avoid RF interference with other electronic equipment in the same mechanical room or in the building.

10. Diagnostic module shall identify faults as they occur, storing them in nonvolatile memory for recall.

11. Provide output LC filter if the conductor from VFD to motor terminal exceeds manufacturer’s recommended length.

L. Interface Features:
1. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the drive and determine the speed reference.

2. Provide a 24 V DC output signal to indicate that the drive is in Auto/Remote mode.

3. Digital manual speed control.

4. Dry contacts for remote enable/disable, capable to take remote signal 4-20mA and 0-10 V.dc for speed adjustment, and dry contacts for VFD failure alarm.

5. Drive may be operated with keypad removed.

6. VFD shall capable to interface with (BAS) Building Automation System involve in the same project with application specific software through serial port communication. Use Siemens RS485 FLN protocol or BacNet RS485 MSTP protocol as required by the specific project.

7. Display shall be programmable to display in plain English.

8. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the drive when the keypad is removed.

9. An elapsed time meter and kWh meter shall be provided.

10. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, Drive Temperature in degrees, and Motor Speed in engineering units per application (in percent speed, GPM, CFM,...). Drive will read out the
selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

11. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.

12. The VFD shall store in memory the last 20 faults and record all operational data.

13. At least three (3) programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

14. Two programmable analog inputs shall be provided and shall accept a direct- or reverse acting signal. Analog reference inputs accepted shall include 0-10 V dc, and 4-20 mA. Analog output signal for remote indication of motor speed 4-20 mA and 0-10v DC.

15. Two programmable analog outputs shall be provided for indication of drive status. These outputs shall be programmable for output speed, voltage, frequency, amps and input kW.

16. Under fire mode conditions the VFD shall automatically default to a preset speed.

M. Adjustments:
1. VFD shall have an adjustable carrier frequency.
2. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves may be automatically contoured to prevent tripping.
3. Four current limit settings shall be provided.

N. Bypass:
1. Depending application if required then provide manual bypass as follows.
2. Provide a manual bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/LINE/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the drive. In the OFF position, the motor and drive are disconnected. In the LINE position, the motor is operated at full speed from the AC power line and power is disconnected from the drive so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power. This allows the drive to be given an operational test while continuing to run the motor at full speed in bypass. A remote normally closed dry contact shall be interlocked with the drives safety trip circuitry to stop the motor whether in DRIVE or BYPASS mode in case of an external safety fault.

O. Service Conditions:
1. Ambient temperature, 14 to 104°F.
2. 0 to 95% relative humidity, non-condensing.
3. Elevation to 3,300 feet without derating.
4. AC line voltage variation, -10 to +10% of nominal with full output.

P. Quality Assurance:
1. To ensure quality and minimize infantile failures at the jobsite, the complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and the load and speed shall be cycled during the test.

2. All optional features shall be functionally tested at the factory for proper operation.

Q. Submittals:

1. Submit manufacturer's performance data including dimensional drawings, system schematic diagrams showing all inputs and outputs to be connected to the control system, termination details, data sheets describing all major components and electrical characteristics plainly demonstrating compliance with each specification requirement, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalog information.

2. The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

2.3 Not used

PART 3 EXECUTION

3.1 Start-up Service

A. The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for VFD field repair shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Start-up shall include customer operator training at the time of the equipment commissioning.

B. Warranty:

1. The VFD shall be warranted by the manufacturer for a period of 24 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

3.2 Examination
A. Supplier representative shall verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

END OF SECTION
SECTION 16000

ELECTRICAL SYSTEMS

1.1 GENERAL

A. Provide sufficient capacity for substantial future growth.

B. All circuits to include ground wire. Each circuit intended for computer power to have individual ground.

C. Provide sufficient quantity of receptacles. Provide corridor receptacles for custodial use (maximum spacing of 30 feet; on separate circuit from office area receptacles).

D. Within individual buildings, match existing switch gear, panel boards, exit lights and any other equipment when possible.

E. Provide S & C fuses on primary. (Surge protection at main panel and at each sub-panel).

F. Major corridor lighting shall be timer controlled (with dual technology occupancy sensor override) to reduce foot-candles to code approved minimum at night and weekends.

G. Concrete encase all underground circuits.

H. All equipment should be rated 15KV minimum.

I. Switched load break rated.

J. Energy saving fixtures and lamps should be utilized at all locations. (Electronic ballast with T-5 or T-8 lamps, compact fluorescent down light fixtures). Use dimmable compact fluorescent fixtures for dimming situations.

K. Restroom lighting should utilize standard fixtures and lamps to match typical in building. Exceptions permitted in special situations with approval of Project Manager.

L. Use metal halide lamps for HID fixtures.

M. Emergency lighting required in all occupied buildings (not including buildings used primarily for storage) utilizing battery backup systems.

N. Wiring devices to be brown with standard size stainless steel cover plates.

END OF SECTION
SECTION 18000

CARD READER SYSTEM

1.1 The Panther Card System is Georgia State University’s implementation of Blackboard Transaction System – UNIX Edition. Most hardware and software is proprietary and can only be purchased from Blackboard. Use of components provided by any source other than Blackboard requires prior approval from Georgia State University.

1.2 The cabling for the loop interfaces is done with BLUE plenum rate CAT 5e cable. The Blackboard readers use a 2-pair RS-485 interface to communicate with either a Blackboard line-driver or to a Blackboard IPCONVERTER. The cable to be run between the Blackboard readers and the card swipes will be WHITE plenum rated CAT 5e cable. This is to differentiate it from the loop interface cable.

1.3 Type of cabling needed between the Card Reader and the lock-sets depends on several factors. This should be discussed with GSU PM and GSU IS&T on a per project basis, especially if the doors are required to be wired into the building fire-alarm system.

1.4 Blackboard Card readers shall not be located in random unsecured locations. Install Blackboard Card readers in common secured areas, generally data-closets on the same floor. However, the decision on whether or not to install any specific readers in a data-closet is to be evaluated on a per project basis. GSU’s IS&T Department must sign-off on the actual physical placement of any equipment on the walls in a data-closet.
SECTION 270000
COMMUNICATIONS

PART 1 – GENERAL

1.1 INTRODUCTION

A. The design and construction of the telecommunications system shall:
   1. Provide telecommunications architecture based on recognized standards to support efficient, long-lasting, cost-effective operations.
   2. Reduce the amount of time required to install new networks or to reconfigure existing local area networks.
   3. Provide the flexibility to operate multiple high bandwidth technologies on a single structured cabling system.
   4. Eliminate the cost of installing non-standard, proprietary, vendor-specific cabling by providing standards-based cabling systems that will support a wide variety of equipment.
   5. Improve network manageability and facilitate automated cabling system management through the use of uniform and industry standard identification and numbering schemes.
   6. Allow for the growth of anticipated high speed, high bandwidth Local Area Networks (LANs), Metropolitan Area Networks (MANs) and Wide Area Networks (WANs) that may be required by future specialized applications.

1.2 STANDARDS:

A. American National Standards Institute (ANSI) approves standards as having been properly developed.
F. ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
G. IEEE 802.3, Local Area Network Ethernet Standard.
I. NFPA 70, National Electrical Code, Article 250, Grounding; Article 645, Information Technology Equipment; Article 770, Optical Fiber Cables and Raceways; Chapter 8, Communications Systems.

1.3 STRUCTURED CABLING SYSTEM (SCS):

A. There are typically eight major components of the SCS as follows:
1. Service Entrance Facilities  
2. Main Equipment Room  
3. Telecommunications Room  
4. Backbone Cabling  
5. Horizontal Cabling  
6. Work Area Outlets  
7. Grounding and Bonding  
8. Administration and Labeling.

1.4 SCOPE:

A. This cabling system shall be based on industry standard SCS's that are not proprietary and conform to current ANSI/TIA/EIA Commercial Cabling Standards.

1.5 QUALIFICATIONS:

A. Telecommunications Installer:
   1. The telecommunications installation contractor shall be licensed in the State of Georgia as a Telecommunications Class or Unrestricted Class Low-Voltage Licensed (LVL) Contractor.
   
   2. The Low-Voltage Licensed Telecommunications Contractor (LVLTC) shall be based in the State of Georgia.
   
   3. The telecommunications Contractor must be certified to extend a NetClear 25-year Static, Dynamic and Applications Warranty. All contractors must be an approved Ortronics Certified Installer at a Plus tier (CIP, CIP-GOLD, and CIP-PLATINUM) and/or Berk-Tek Certified OASIS Integrator in the State of Georgia. A copy of certification documents must be submitted with the quote in order for the quote to be valid. The Telecommunications Contractor is responsible for workmanship and installation practices in accordance with the Ortronics CI/CIP Program and Berk-Tek OASIS Program. At least 30 percent of the copper installation and termination crew must be certified by BICSI, Berk-Tek, or Ortronics with a Technicians Level of Training.
   
   4. The electrical contractor shall not perform or share the telecommunications work or subcontract the work to a LVLTC.
   
   5. The LVLTC Project Manager shall act as a single point of contact for activities regarding this project. The Project Manager shall be required to make on-site decisions regarding the scope of the work and changes required by the work. The Project Manager shall be the job-site whenever work is being performed or workers are present.
   
   6. The Project Manager shall notify the appropriate RCDD, telecommunications system designer and the Agency’s Inspector of change requests and inspections. Final approval for change requests must be obtained prior to commencement of work. Scheduling and coordinating inspections between the LVLTC and the Agency’s Inspector is critical.
7. The selected LVLTC shall be fully capable and experienced in the installation of telecommunications distribution systems and have a minimum of five (5) years of experience installing SCS’s. To ensure the system has continued support, the Agency will contract only with a LVLTC having a successful history of SCS installations.

8. The Agency may, with full cooperation of the LVLTC, visit installations to observe equipment operations and consult with references. Specified visits and discussion shall be arranged through the LVLTC; however, the LVLTC personnel shall not be present during discussions with references. The LVLTC must provide a minimum of three (3) reference accounts at which similar work, both in scope and design, have been completed by the LVLTC within the last two (2) years.

9. In the event multiple Vendors submit a joint response, a single Vendor shall be identified as the Prime Vendor. Prime Vendor responsibilities shall include performing overall project administration and serving as a focal point for the state to coordinate and monitor plans, schedules status information and administer changes required. The Prime Vendor shall remain responsible for performing tasks associated with installation and implementation of the entire telecommunications project.

1.6 SUBMITTALS:

A. The LVLTC shall submit shop drawings and product data to the designer for review and approval prior to commencement of work.
B. The LVLTC shall indicate installation details, cable routing, system configuration, and outlet numbering on shop drawings.
C. The LVLTC shall submit appropriate product data for each component to be supplied.
D. The LVLTC shall submit manufacturer's installation instructions.
E. The LVLTC shall submit three copies of a complete, bound, project record manual consisting of the following:
   1. Product cut sheets for products supplied.
   2. Test reports for horizontal cabling.
   3. Test reports for backbone cabling.
   4. Manufacturer’s warranties.
F. The As-built drawings shall accurately record location of service entrance conduit, termination backboards, outlet boxes, cable raceways, cable trays, pull boxes, and equipment racks electronically using AutoCAD’s latest version and on a minimum “D” size reproducible paper prints.
G. The LVLTC shall prepare 11” x 17” as-built serving zone drawings for each TR. The drawings shall be laminated, framed and secured to the wall in the MER and TR.

1.7 WARRANTIES:

A. The LVLTC shall furnish a manufacturer’s warranty of products, applications and workmanship for 25 years from the date of acceptance by the state. Products and
workmanship shall carry warranties equal to or greater than the warranty from the date of acceptance by the state.
B. Materials and workmanship shall be fully guaranteed by the LVLTC for 25 years from transfer of title against defects. The defects which may occur, as the result of faulty materials or workmanship within 25 years after installation and acceptance by the Agency shall be corrected by the LVLTC at no additional cost to the Agency.
C. The LVLTC shall promptly, at no cost to the Agency, correct or re-perform (including modifications or additions as necessary) nonconforming or defective work within 25 years after completion of the project.
D. The LVLTC shall procure equipment and materials that carry warranties against defects and workmanship whenever available. The LVLTC shall transfer to the Agency Owner additional warranties offered by the manufacturers, at no additional costs to the Agency.
E. The LVLTC’s obligation under its warranty is limited to the cost of repair of the warranted item or replacement thereof, at the LVLTC’s option. Insurance covering said equipment from damage or loss is to be borne by the LVLTC until full acceptance of equipment and services.

1.8 CABLE DEMOLITION – REMOVAL OF VOICE & DATA SYSTEMS:

A. For all renovation and retrofit projects, the contractor shall be responsible for the demolition of all existing voice, data, and CATV cabling systems, in accordance with all NEC and NFPA mandates. The contractor shall be required to coordinate all demolition activities with Georgia State University. All University requirements shall be strictly enforced to minimize service disruptions and confusion over what activities must take place.

B. There are three types of communication cable on the Georgia State University campus, and each type must be removed in a unique way. When removing existing voice, data, or CATV systems, the first step is to identify the system as belonging to one of the following categories:
   1. The current University telecommunications system.
   2. An original University system, in service or out of service.
   3. Part of a legacy system, in service or out of service.

C. Demolition requirements shall proceed as follows:
   1. Notify Owner’s Representative so that the existing infrastructure system can be taken out of service or confirmed as out of service. Note – GSU staff shall be responsible for removal of all cross connect cables or patch cables in Telecom Rooms.
   2. After confirmation from GSU, the contractor shall be responsible for the removal of all existing telecom cable from the field outlet back to the telecom room.
   3. For surface mount raceway, contractor shall turn-over all surface mount raceway to GSU, unless noted otherwise.

1.9 TELECOM RACEWAY DEMOLITION – REMOVAL OF VOICE & DATA SYSTEMS:

A. For all renovation and retrofit projects, the contractor shall be responsible for the
demolition all existing telecom raceway systems. The contractor shall be required to coordinate all demolition activities with Georgia State University. All University requirements shall be strictly enforced to minimize service disruptions and confusion over what activities must take place.

B. When removing existing conduit, contractor shall cut off conduits below finished floor and patch opening.

C. Outlet or Pull Box Accessibility: When an outlet or junction box becomes inaccessible for any reason, the junction box must be relocated and all associated conduit and wiring modified and re-routed as required in order to maintain accessibility.

D. Reuse of Existing Conduits: When approved by GSU, the contractor shall be permitted to re-use existing conduit runs for installing new telecommunication infrastructure systems within the following guidelines:
   1. The contractor shall remove all cables in the existing conduits between the designated outlet and the telecom room of origin.
   2. When existing conduit is re-used it is the responsibility of the contractor to re-support conduit as required per the National Electric Code and project specifications. The contractor is cautioned that any existing conduit relying on an existing ceiling support system must be re-supported per the current National Electric Code requirements. As required, all conduit in question must be re-installed and re-supported as required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – OPTICAL CONNECTIVITY SYSTEM

A. All optical fiber cables and components shall be provided and installed by manufacturer certified installers that shall provide an extended warranty of 25 years for certified installations. Manufacturer shall provide warranties and contractor shall provide documentation of certification by manufacturer. Acceptable fiber solutions shall be the products of the following manufacturers:
   1. Corning Cabling System.

B. All materials and workmanship shall be fully guaranteed by the contractor for 25 years from transfer of title against defects. The defects which may occur, as the result of faulty materials or workmanship within the 25 years after installation and acceptance by the owner shall be corrected by the contractor at no additional cost to the owner. The contractor’s warranties should commence with acceptance of/or payment for the work in full.

2.2 ACCEPTABLE MANUFACTURERS – COPPER CONNECTIVITY SYSTEM

A. All copper cables and components shall be provided and installed by manufacturer certified installers that shall provide an extended warranty of 25 years for certified installations. Manufacturer shall provide warranties and contractor shall provide documentation of certification by manufacturer. Acceptable copper solution manufacturers shall be the products of the following manufacturers:
1. NetClear Cabling Solution: Ortronics/Legrand Connectivity & Berk-Tek Cabling

B. All materials and workmanship shall be fully guaranteed by the contractor for 25 years from transfer of title against defects. The defects which may occur, as the result of faulty materials or workmanship within the 25 years after installation and acceptance by the owner shall be corrected by the contractor at no additional cost to the owner. The contractor’s warranties should commence with acceptance of/or payment for the work in full.

2.3 SUBSTITUTIONS

A. Where equipment is identified by manufacturer and catalog number, it shall be as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the Contractor may submit for approval, similar equipment of other manufacturers as substitution. The Engineer’s decision as to whether the submitted equipment is acceptable shall be final and binding.

B. All changes necessary to accommodate the substituted equipment shall be made at the Contractor’s expense, and shall be as approved by the Engineer. Detailed Drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

C. If substitutions are made in lieu of device specified; form, dimension, design and profile shall be submitted to the Engineer for approval.

D. Submit request for approval of substitute materials in writing to Architect at least ten days prior to bid opening.

2.4 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters’ Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer,
but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

PART 3 – EXECUTION

3.1 EXAMINATION OF SURFACE CONDITIONS

A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Manager.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.2 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

D. As determined by the Project Manager, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Project Manager shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.3 ACCESS TO EQUIPMENT
A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC) for voltages specified.

C. Where the Project Manager determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. "Conveniently accessible" is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

3.4 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by telecommunications work.

B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.5 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

B. Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Testing, start-up and cleaning work shall be complete.

C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.6 TESTING AND VERIFICATION

A. See specific Division 27 sections for testing parameters of sub-systems.

B. The Contractor shall verify that requirements of this specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.
D. The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the telecommunications systems, components and subsystems meet specification requirements in the "as-installed" operating environment during the "System Operation Test". Even though no formal environmental testing is required, the Contractor shall measure and record temperature, humidity and other environmental parameters and the environmental conditions, which were encountered during the "System Operation Test".

E. The Contractor shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Contractor shall provide necessary instruments, labor and materials required for tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time period.

F. The Contractor shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. After the Contractor systems have been installed and tested, the completed test plan shall be signed by the Telecommunications Contractor Project Manager and submitted for approval.

END OF SECTION
SECTION 270526

GROUNDING & BONDING FOR COMMUNICATION SYSTEMS

PART 1 – GENERAL

1.1 GROUNDING AND BONDING

A. The National Electrical Code (NEC) provides grounding, bonding, and electrical protection requirements to ensure life safety. Modern telecommunications systems require an effective grounding infrastructure to ensure optimum performance of the wide variety of electronic information transport systems that may be used throughout the life of a building. The grounding and bonding requirements of ANSI/TIA/EIA-607 are intended to work in concert with the cabling topology specified in ANSI/TIA/EIA-568, and installed in pathways and spaces as specified in ANSI/TIA/EIA-569. The requirements of these standards, and of this manual, are in addition to the requirements of the NEC.

B. Conduits for Backbone and Horizontal Cabling Pathways shall be bonded to the grounding electrode system per the NEC.

C. All conduits shall be bonded to the grounding system as per NEC.

D. Telecommunications grounding, bonding, and electrical protection at state facilities shall comply with the requirement of the NEC, ANSI/TIA/EIA-607, and the additional requirements stated herein.

E. Telecommunications Main Grounding Busbar (TMGB)
   1. The TMGB shall be installed at an accessible and convenient location in each Entrance Facility.
   2. The TMGB shall be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing. The busbar shall be ¼-inch thick x 4-inch wide, with length sized to accommodate ground connection of telecommunications racks, equipment, and shielded cables in the room, plus provision for 30% growth.
   3. The TMGB shall be bonded to the building main electrical service-grounding electrode. No other grounding point for the TMGB shall be allowed. The TMGB shall not be bonded independently to water pipe, structural steel or electrical conduit.

F. Telecommunications Ground Busbar (TGB)
   1. The Telecommunications Grounding Busbar (TGB) shall be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing. The busbar shall be ¼-inch thick x 2-inch wide, with length sized to accommodate ground connection of all telecommunications racks, equipment, and shielded cables in the room, plus provision for 30% growth. The TGB shall be installed in each of the Telecommunications Rooms.

   2. The TGB’s shall be bonded together by a #2 AWG continuous, green insulated ground wire from the TMGB. Each TGB will be tapped off of the #2 ground wire by a #2 AWG green insulated wire.
G. Equipment Racks, Equipment Cabinets and Cable Ladder Racks
1. Equipment racks, equipment cabinets, cable ladder racks and exposed non-current carrying metal parts of the telecommunications Structured Cabling System shall be bonded to the TMGB or TGB.

2. Each section of a cable ladder rack or tray, shall be bonded together by one of three ways:
   a. Remove paint down to bare metal at the point where the rack section interconnection hardware is mounted. Bond the rack assembly to the TMGB or TGB with a #6 AWG ground wire unless noted otherwise.
   b. Bond individual rack sections together using braided metal bonding straps or #6 AWG ground wires. The straps or ground wire shall be attached with bolts through holes drilled in the cable rack sections. The bolts must contact bare metal on the rack sections. Bond the rack assembly to the TMGB or TGB with a #6 AWG ground wire unless noted otherwise.
   c. Bond individual rack sections to a #6 AWG ground cable unless noted otherwise run throughout the entire length of the rack. The ground cable shall be bonded to the TMGB or TGB.

H. Grounding and Bonding of Backbone Cables
1. OSP copper backbone cables shall have the metallic cable shields bonded to the ground lug of the primary protector block at the entrance to each building.
2. Optical fiber cables that contain metallic shielding or metallic strength members must have those metallic components bonded to the TMGB at each end of the cable.
3. Inside plant copper or optical fiber backbone cables that contain metallic shielding shall have their shields bonded to the TMGB at each end.
4. The metallic shield of splices made to backbone cables shall be bonded together to maintain shield continuity.

PART 2 – PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Equipment Grounding Conductor manufacturer(s):
   1. Southwire
   2. West Penn
   3. Belden
   4. Panduit

B. Approved Grounding Lug manufacturer(s):
   1. Burndy
   2. Thomas & Betts
   3. Chatsworth Products, Inc.
   4. Ortronics/Legrand
   5. Panduit

C. Approved Grounding Busbar manufacturer(s):
   1. Burndy
   2. Thomas & Betts
2.2 TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

A. GROUNDING AND BONDING
1. Service Entrance TMGB
   a. The TMGB shall be bonded to the Main Electrical service building ground by means of a 3/0 AWG, green insulated ground wire. Reference J-STD-607-A, Figure 5.4.4.1.
   b. Label grounding and bonding hardware and connections per ANSI/TIA/EIA 606-A.
   c. The ground busbar assembly shall be copper, 1/4" x 4" x 23" with insulators and support bracket. Provide lugs for each Bonding Conductor (BC) and the Telecommunications Bonding Backbone (TBB). Hardware (bolts) shall be silicone bronze and lugs shall be copper alloy sized for connecting the BC and TBB to the TMGB and TGB.
   d. Rack mounted equipment ground busbar shall be 3/16" x 3/4" x 18 5/16" for attachment to 19" mounting rails of equipment racks and cabinets. Provide splice plates for attachment to multiple equipment racks and cabinets, #6-32 silicon bronze screws, ground lugs and mounting hardware.

2.3 MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

A. GROUNDING AND BONDING
1. The TGB shall be bonded to the Main Electrical service building ground by means of a #2 AWG, green insulated bonding conductor. Reference J-STD-607-A, Figure 5.4.4.1.
2. Label grounding and bonding hardware and connections per ANSI/TIA/EIA 606-A.
3. The ground busbar assembly shall be copper, 1/4" x 4" x 13.5" with insulators and support bracket. Provide lugs for each BC and the TBB. Hardware (bolts) shall be silicone bronze and lugs shall be copper alloy sized for connecting the BC and TBB to the TMGB and TGB.
4. Rack mounted equipment ground busbar shall be 3/16" x 3/4" x 18 5/16" for attachment to 19" mounting rails of equipment racks and cabinets. Provide splice plates for attachment to multiple equipment racks and cabinets, #6-32 silicon bronze screws, ground lugs and mounting hardware.

2.4 TELECOMMUNICATIONS ROOMS

A. GROUNDING AND BONDING
1. The TGB shall be bonded to the Main Electrical service building ground by means of a #2 AWG unless noted otherwise, green insulated ground wire.
2. Label grounding and bonding hardware and connections per ANSI/TIA/EIA 606-A.
3. The ground busbar assembly shall be copper, 1/4" x 4" x 13.5" with insulators and support bracket. Provide lugs for each BC and the TBB. Hardware (bolts) shall be silicone bronze and lugs shall be copper alloy sized for connecting the BC and TBB to the TMGB and TGB.
4. Rack mounted equipment ground busbar shall be 3/16” x 3/4” x 18 5/16” for attachment to 19” mounting rails of equipment racks and cabinets. Provide splice plates for attachment to multiple equipment racks and cabinets, #6-32 silicon bronze screws, ground lugs and mounting hardware.

2.5 ADMINISTRATION AND LABELING
A. The BC shall be provided with a self adhesive, self laminating, mechanically printed label with a clear protective laminating over wrap or mechanically printed heat shrink tubing. The label shall be approved by the Agency prior to application.

B. The TGB and TMGB shall be provided with a copper, brass or 1/16” mechanically stamped tag, 3” square surface area minimum, legible and permanently affixed. The tag shall be approved by the Agency/RCDD prior to application.

2.6 GROUNDING
A. Comply with requirements in Division 26 Specifications Section for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:
   1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt copper alloy lugs for connection to ground bus bar.
   2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
   3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

D. Label grounding and bonding hardware and connections per ANSI/TIA/EIA-606-A.

2.7 PROTECTOR BLOCKS
A. Provide multi-pair protection panels for protection of all copper circuits routed between buildings.

B. At all noted locations, provide protector panel with individual protection units and mount on voice backboards. Provide protector units for all copper circuits.

C. Protector units shall be wide-gap, gas tube surge arrestors that provide over-voltage protection. The protector units shall also include heat coils for sneak current protection.

PART 3 – EXECUTION

3.1 TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

A. GROUNDING AND BONDING
   1. The LVLTC shall install the grounding busbar as required by ANSI/TIA/EIA 607-A and the NEC.
2. Equipment racks, conduits, cable trays, ladder racks, etc. shall be bonded to the grounding busbar.
3. Bonding connectors and clamps shall be mechanical type made of silicon bronze.
4. Terminals shall be solderless compression type, copper long-barrel NEMA two bolts.
5. The LVLTC shall bond the shield of shielded cables to the grounding busbar per applicable code and manufacturers recommended practices.
6. Grounding and bonding shall be in accordance with ANSI/TIA/EIA-607-A and the NEC.
7. Labeling shall be in accordance with ANSI/TIA/EIA 606-A.

3.2 MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

A. GROUNDING AND BONDING
   1. The LVLTC shall install the grounding busbar as required by ANSI/TIA/EIA 607-A and the NEC.
   2. Equipment racks, conduits, cable trays, ladder racks, etc. shall be bonded to the grounding busbar.
   3. Bonding connectors and clamps shall be mechanical type made of silicon bronze.
   4. Terminals shall be solderless compression type, copper long-barrel NEMA two bolts.
   5. The LVLTC shall bond the shield of shielded cables to the grounding busbar per applicable code and manufacturers recommended practices.
   6. Grounding and bonding shall be in accordance with ANSI/TIA/EIA-607-A and the NEC.
   7. Labeling shall be in accordance with ANSI/TIA/EIA 606-A.

3.3 TELECOMMUNICATIONS ROOMS

A. GROUNDING AND BONDING
   1. The LVLTC shall install the grounding busbar as required by ANSI/TIA/EIA 607 and the NEC.
   2. Equipment racks, conduits, cable trays, ladder racks, etc. shall be bonded to the grounding busbar.
   3. Bonding connectors and clamps shall be mechanical type made of silicon bronze.
   4. Terminals shall be solderless compression type, copper long-barrel NEMA two bolts.
   5. The LVLTC shall bond the shield of shielded cables to the grounding busbar per applicable code and manufacturers recommended practices.
   6. Grounding and bonding shall be in accordance with ANSI/TIA/EIA-607 and the NEC.
   7. Labeling shall be in accordance with ANSI/TIA/EIA 606-A.

3.4 GROUNDING

A. Install grounding according to the BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.
C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 3/0 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 ADMINISTRATION AND LABELING

A. The LVLTC shall permanently secure the label within six (6) inches from both ends of the BC.
B. The LVLTC shall permanently secure the tag within six (6) inches from the TMGB and TGB.

END OF SECTION
SECTION 270528
PATHWAYS FOR COMMUNICATION 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. GENERAL

A. Telecommunications Space Overview
   1. The design of spaces to house telecommunications cabling and equipment shall be in accordance with ANSI/TIA/EIA 569A: Commercial Building Standard for Telecommunications Pathways and Spaces and addenda to this standard.

1.3. MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

A. The Equipment Room shall be connected to the backbone pathway for cabling to the Telecommunications Entrance Facility and the Telecommunications Rooms.

1.4. BACKBONE PATHWAYS

A. The TRs shall have vertical 4” ID minimum conduit sleeved holes to the TR above provided by Division 25. Each TR shall have 4” sleeves provided by Division 25 between them. If the TRs are offset, multiple 4” conduits between them shall be provided by Division 25. An extra minimum 1-inch metallic sleeve shall be provided by Division 25 for the vertical riser ground system.

B. Sleeves provided by Division 25 will extend below the ceiling and above the floor 4” with a 2” clearance from the finished wall.

C. Firestop material shall be installed in sleeves.

PART 2 – PRODUCTS

2.1. APPROVED PRODUCTS

A. All structured cabling systems to be routed in EMT conduit. See electrical specifications for conduit requirements.

2.2. FIBER INNERDUCT

A. Each fiber conduit to be provided with full complement of Maxcell innerduct system.
2.3. PULL BOXES

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.

B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.

C. Pull boxes shall have provisions for grounding.

PART 3 – EXECUTION

3.1. PENETRATIONS

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Project Manager as required by limited working space. X-ray all floor penetrations accordingly.

B. Holes shall be located so as not to affect structural sections such as ribs or beams.

C. Holes shall be laid out in advance. The Project Manager shall be advised prior to drilling through structural sections, for determination of proper layout.

D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.

E. All penetrations where conduit is not used shall be sleeved.

F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.2. CONDUIT SYSTEM

A. All conduits shall not be less than 1” trade size.

B. No more than two 90 degree sweep bends or the equivalent shall be permitted between junction boxes, pull boxes, cabinets, or cable access points.

C. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.

D. Leave all empty conduits with a 200 pound test nylon cord pull line.

E. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

F. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.
G. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

H. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.

I. Attach backbone conduits larger than one-inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.

J. Where conduits must pass through structural members obtain approval of Architect.

K. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

L. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

M. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (G.R.S.) or intermediate metal conduit (IMC). Service entrance conduits shall be installed "outside" of the building as defined by the N.E.C. Provide concrete encasement where required or as indicated on Drawings.

N. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas. PVC to be installed below concrete in grade. Contractor to utilize Rigid Galvanized Steel (RGS) elbows for all slab penetrations and stub-ups.

O. Conduit Installations Within Slab/Floor

1. Conduit shall be run following the most direct route between points.
2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
3. Conduits shall not be installed within shear walls unless specifically indicated on the Drawings. Conduit shall not be run directly below and parallel with load bearing walls.
4. Protect each metallic conduit installed in concrete slab or conduits 1-1/2 inch and smaller passing through a concrete slab against corrosion where conduit enters and leaves concrete by wrapping conduit with vinyl all-weather electrical tape.
5. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
6. Provide expansion fittings in all conduits where length or run exceeds 200 feet or where conduits pass through building expansion joints.
7. Install all conduits penetrating or routed within rated fire floors to maintain the fire rating of the floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
8. Conduits installed within concrete floor slabs which are in direct contact with grade or which penetrate the building roof shall be galvanized rigid steel (G.R.S.), intermediate metal conduit (I.M.C.).

P. Telecommunications cables shall not occupy conduits with power cables.

Q. Metallic conduits shall be grounded in accordance with J-STD-607-A.

R. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.

S. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

T. Telecommunications conduit system shall contain no condulets (also known as an LB).

U. Horizontal Conduits

1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

3.3 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

C. Pull boxes shall be free from burrs, dirt and debris.

D. Pull boxes shall be installed in accordance with ANSI/TIA/EIA-569-A.

E. Pull boxes shall be grounded in accordance with J-STD-607-A.

END OF SECTION
SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATION SYSTEMS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 00 00 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Administration & Labeling for Communications Systems.

C. Equipment specifications, general considerations, and guidelines are provided in this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

A. Provide the following submittals:
   1. Product data
   2. Product samples
   3. Label sample showing example and text size for each item
   4. Software program sample

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Perform all Labeling.

PART 2 – PRODUCTS

2.1 LABELS

A. All labels shall be vinyl.

B. All labels shall have an adhesive backing for permanent attachment.

C. All labels shall be of sufficient size. Minimum sizes shall be as follows:
   1. 1-1/2"W x 3/16"H for:
      a. Outlets
      b. Outlet cables
c. Patch panels
d. Ground wires
e. Backbone cable pairs

2. 4"W x 1"H for:
   a. Backbone cables
   b. Equipment racks
c. MDF frames
d. Active hardware and multiplexers

3. 3" Square Tag mechanically stamped, legible, and permanent affixed. Tag shall be copper, brass, or 1/16" plastic.
   a. Cable Tray
   b. Riser Backbone Conduits
c. Backbone Conduits

2.2 LABEL HOLDERS

A. Labels attached to backbone cable bundles shall be installed on a label holder of sufficient size. Label holder to be plastic and have tie-wrapping provisions.

2.3 SOFTWARE PROGRAM

A. Software program shall be of the following types or similar:
   1. PANDUIT labeling program
   2. Brady labeling program
   3. Thomas & Betts labeling program
   4. Excel, customized

2.4 TEMPORARY LABELS

A. Vinyl labels, hand written, with permanent marker.

2.5 CHARTS

A. Provide printed charts containing required punch down and cross-connect information. Charts to be computer generated. File information shall be turned over to owner in printed and electronic format four (4) weeks prior to job completion.

2.6 AS-BUILT PLAN

A. Description: At the completion of the project, provide an "as-built" floor plan of each floor to the Architect.

PART 3 – EXECUTION

3.1 LABELING REQUIREMENTS
A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA/EIA-606 document, manufacturer's recommendations and best industry practices.

B. All spaces, pathways, outlets, cables, termination hardware, grounding system and equipment shall be labeled with machine-generated labels.

C. All labels shall be clear with black text.

D. All cables shall be labeled with machine generated, wrap around labels.

E. A total of three (3) labels per horizontal cable are required at the following intervals: 6" from outlet; 18" from outlet; 12" from termination block/patch panel.

F. Labeling scheme shall be alphanumeric.

G. Provide and generate all labeling (no labels will be furnished by the owner).

H. Labels shall be developed and printed using a software program.

I. Software program and all inputs shall be turned over to the owner at the end of the project.

3.2 INSTALLATION

A. All labels shall be installed straight.

B. Provide labels at locations as indicated on the Drawings and as follows:

   1. Outlet face plates
   2. Inside of outlet boxes
   3. Outlet cable inside box
   4. Outlet cable in ceiling above outlet
   5. Outlet cables at poke through entrance on both sides
   6. Outlet cable at rear of patch panel.
   7. Port at rear of patch panel
   8. Port on front of patch panel
   9. Individual fiber strands at rear of patch panel
   10. Backbone cables & conduits whenever exposed on minimum 10' intervals
   11. Backbone cable & conduit at point of termination
   12. Ends of any cored cable put in place that is not terminated
   13. On front of racks, cabinets frames, active hardware, multiplexers
   14. Cable tray.

3.3 LABELING SCHEME

A. In general the following items shall receive labeling:

   1. Outlets - (EX. Telecom room#. Patch panel#. Port #) or (EX. 139.1.3) 139 is the telecommunications room where the cable originates, 1 is the Patch panel #, and 3 is the third port on the patch panel.
   2. Outlet cables
3. Backbone cables - (CVR=139) copper backbone to room 139, 1-25, 26-50, 51-75, etc - 200
4. Patch panels - (ex. PP#1, PP#2, etc)
5. Patch panel ports (each) - (EX. Office room #. Patch panel- Sequential port #)
   or (EX. 150.1.3) 150 is the office room number, 1 is the patch panel and 3 is the third port.
6. Equipment racks and cabinets - (EX. Rack 1, rack 2, etc)
7. Ground wires
8. Active hardware and multiplexers (by owner)

3.4 TEMPORARY LABELS

A. Provide temporary labels on all outlet cable as it is roughed-in. The bid documents will not show outlet/cable labeling at the time of the cable rough-in. Replace temporary labels with permanent labels after contract documents have been revised.

3.5 TEXT SIZE AND INFORMATION

A. Text size should be as large and as bold as possible.
B. Exact text required information is shown on the Drawings
C. Refer to Drawings for all outlet, outlet cables, and backbone cables labels.
D. Refer to the Cover Drawing for exact labeling coding schemes, where applicable.

3.6 LABELING AND REFERENCE CHARTS

A. Contractor to provide a labeling reference chart(s) indicating the following:
   1. Backbone termination of pairs at the local telecommunication room (TR) and main telecommunications room (MR).
   2. Horizontal outlet cable pair termination at the TR.
   3. Data patch panel outlet port termination.

3.7 AS-BUILT PLAN & FRAME

A. Provide and mount frame with "as-built" on all TR walls and File Server room wall near the data racks, or as indicated on the plans.

END OF SECTION
SECTION 27 08 00

COMMISSIONING OF COMMUNICATIONS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The Architect/Engineer reserves the right to attend construction meetings, inspect the job site during construction to ensure compliance with telecommunication codes and standards.

B. The Architect/Engineer shall be included in all phases of the project.

1.2 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Perform all Copper Cabling Testing.
   2. Perform all Optical Fiber Cabling Testing.
   3. Perform all CATV System Testing
   4. Provide all Documentation, As-Builts, Training and Warranty.

PART 2 – TESTING

2.1 TESTING REQUIREMENTS

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs/strands of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors/strands in all cables installed.

B. Copper Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category 6 and Category 5e performance. Horizontal balanced twisted pair cabling shall be tested using a level III test unit for category 6 compliance and performance up to 550 MHz & category 5e compliance and performance up to 350 MHz.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

3. Length - each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B-1 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in the RFP and/or Drawings. These tests also include continuity checking of each fiber.

2. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-7 and/or ANSI/TIA/EIA-526-14 Standards, and to the manufacturer's application guides.

3. Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.

4. Multimode
   a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter / light source. Fiber must be tested at both 850nm and 1300nm. Maximum attenuation dB/Km @ 850nm/1300nm shall be 3.5/1.5. Maximum attenuation per connector pair shall be .75 dB.

5. Singlemode
   a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter / light source. Fiber must be tested at both 1310nm and 1550nm. Maximum attenuation dB/Km @ 1310nm/1550nm shall be 0.5/0.5 for outside plant and 1.0/1.0 for inside plant. Maximum attenuation per connector pair shall be .75 dB.

D. Test Results

1. Test documentation shall be provided on disk as part of the as-built package. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the
equipment during the test as well as the software version being used in the field test equipment.

2. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-B.3.

3. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the contractor may furnish this information in electronic form (3.5" diskette or CD). These diskettes or CDs shall contain the electronic equivalent of the test results as defined by the bid specification and be of a format readable from Microsoft Word.

4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 - DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.1 DOCUMENTATION & AS-BUILTS

A. As-Built record documentation for telecommunications work shall include:
   1. Cable routing and identification
   2. System function diagrams
   3. Manufacturers' description literature for equipment
   4. Connection and programming schedules as appropriate
   5. Equipment material list including quantities
   6. Spare parts list with quantities
   7. Details not on original Contract Documents
   8. Test Results
   9. Warranties
   10. Release of Liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract Drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of Telecommunications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Manager and Owner. As-built drawings shall be generated in AutoCad 2004 or later. Submit as-built drawings electronically on C.D. and hard copy.

3.2 OPERATIONS AND MAINTENANCE MANUAL
A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.
   1. Operations manuals for components and for systems as a whole.
   2. Maintenance manuals for components and for system as a whole.
   3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details.
   4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
   5. Emergency instructions for operational and maintenance requirements.
   6. Delivery time frame for replacement of component parts from suppliers.
   7. Recommended inspection schedule and procedures for components and for system as a whole.
   8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
   9. Complete "Reviewed" shop drawings and product data for components and system as a whole.
  10. Troubleshooting procedures for each system and for each major system component.

3.3 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

3.4 WARRANTY

A. General
   1. All equipment is to be new and warranted free of faulty workmanship and damage.
   2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the owner.
   3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Horizontal Structured Cabling
   1. Low voltage contractor shall provide a 25-year manufacturer warranty for components used in the installed Structured Cabling System. Defective
and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner and GTA RCDD.

C. Pathway & Support Infrastructure
   1. Manufacturer(s) shall provide a 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION
SECTION 27 11 00

EQUIPMENT ROOM COMPONENTS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 00 00 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cabinets, Racks & Enclosures.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of telecommunications equipment and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

A. Provide product data.

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Equipment Racks.
   2. Furnish and install all Equipment Cabinets.
   3. Furnish and install all Equipment Shelves.
   4. Furnish and install all Backboards.

PART 2 – PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Standard Equipment Rack manufacturer(s):
   1. Chatsworth Products, Inc.

B. Approved High Density Equipment Rack manufacturer(s):
   1. Chatsworth Products, Inc.

C. Approved Equipment Cabinet manufacturer(s):
2.2 EQUIPMENT RACKS

A. Equipment Racks
   1. The equipment rack shall be constructed of high strength, lightweight aluminum.
   2. The vertical rails of the equipment rack shall be equipped with the EIA hole pattern.
   3. Rack shall be: 7'H x 19"W floor mounted.
   4. Rack color shall be clear.

PART 3 – EXECUTION

3.1 EQUIPMENT RACKS/CABINETS/SHELVES

A. Equipment racks shall be securely attached to the concrete floor using four (4) 1/2" diameter bolts and associated hardware (anchors & washers) or as required by local codes.

B. Equipment racks/cabinets/shelves shall be installed as per the requirements specified by the manufacturer's installation guidelines.

C. Equipment racks/cabinets shall be placed with a minimum clearance of 30 inches in the front and 30 inches in the rear or as indicated on Drawings.

D. All equipment racks/cabinets shall be grounded to the telecommunications ground bus bar.

E. Mounting screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

3.2 BACKBOARDS

A. Backboards shall be 3/4" fire-retardant void free plywood. Size of backboard shall be 8' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint (Additive Acceptable).

3.3 IDENTIFICATION

A. Refer to section 27 05 53 for labeling details.

END OF SECTION
SECTION 27 11 13

FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 00 00 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Firestopping for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Typical firestopping installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

A. Product data: Manufacturer's specifications and technical data including the following:

B. Detailed specification of construction and fabrication.
   1. Manufacturer's installation instructions.

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

C. Furnish and install all Firestopping Materials.

PART 2 – PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Firestopping manufacturer(s):

   1. Flamestopper Thru-Wall Fitting - Wiremold Company (Firestop Devices)
   2. Unique Firestop Products (Firestop Devices)
   3. STI Firestop Products (Firestop Devices, Putties, Caulks, Sealants, etc.)
   4. Hilti (Putties, Caulks, Sealants, etc.)

2.2 TYPES OF PRODUCTS

A. Sealants
   1. Intumescent Firestop Sealants and Caulks
   2. Latex Firestop Sealant
   3. Acrylic Water-Based Sealant
   4. Silicone Firestop Sealants and Caulks
   5. Firestop Putty
   6. Firestop Collars
   7. Wrap Strips
   8. 2-Part Silicone Firestop Foam
   9. Firestop Mortar
   10. Firestop Pillows
   11. Elastomeric Spray
   12. Accessories:
       a. Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation.

B. Firestop Devices
   1. Thru-Wall Fitting (Flamestopper by Wiremold)
      a. The firestop device box shall be constructed of 16 gage G90 steel.
      b. The firestop device intumescent block shall be constructed of a graphite base material with expansion starting at 375°F and an unrestrained expansion between 6 to 12 times. The intumescent block shall be held securely by the box in order to prevent tampering and damage during installation.
      c. The firestop device shall have doors which can be adjusted to prevent materials from penetrating the device if the device is empty or completely full. The doors shall be constructed of 16 gage G90 steel with No. 10-32 screws used to adjust opening size.
      d. The firestop device shall be available for 2" and 4" trade size EMT conduit.
      e. The firestop device shall be available in safety yellow powder coat, custom colors and an unpainted galvanized finish.
   2. Threaded Firestop Device (Unique Firestop Products)
      a. Threaded steel sleeve device incorporating flat washers secured by threaded device shall be installed around cables. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
   3. Smooth Firestop Device (Unique Firestop Products)
      a. Smooth steel sleeve device incorporating flat washers secured by sliding compression couplers. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
   4. Split-Sleeve Firestop Device (Unique Firestop Products)
      a. Threaded steel sleeve halves incorporating split couplings and slotted washers to fit the specific diameter of the opening. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
5. Fire Rated Cable Pathway (STI EZ-PATH)
   a. Fire rated cable pathway device modules shall be comprised of steel raceway with intumescent foam pads allowing 0-100 percent cable fill.

2.3 UL CLASSIFICATION

A. Thru-Wall Fitting - The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814) and bear the U.S. and Canadian UL Classification Mark.

B. Threaded, Smooth and Split-Sleeve Firestop Devices - Firestopping sealants and devices shall be used together as a firestop system. All firestop systems shall bear a UL Classification system number. UL Classification system numbers are as follows:
   1. Threaded Firestop System
      a. Block Wall - W-J-3049
      b. Dry Wall - W-L-3138
   2. Threaded Firestop System (Vertical)
      a. Slab - F-A-3010
      b. Smooth Firestop System
      c. Block Wall - W-J-3048
      d. Dry Wall - W-L-3137
   3. Split-Sleeve Firestop System
      a. Block Wall - W-J-3047
      b. Dry Wall - W-L-3136

2.4 FIRESTOPPING SYSTEMS

A. Thru-Wall Fitting Firestop System:
   1. The device shall be classified for use in one-, two-, three, and four-hour rated gypsum, concrete and block walls and provide a maximum L rating of six cfm. The devices shall also been tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

B. Threaded, Smooth and Split-Sleeve Firestop Systems:
   1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
   2. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
   3. For joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.

C. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

E. Firestopping sealants must be flexible, allowing for normal pipe movement.

F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

PART 3 – EXECUTION

3.1 CONDITIONS REQUIRING FIRESTOPPING

A. General:
   1. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations:
   1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations:
   1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.

D. Construction Joints/Gaps:
   1. Firestopping shall be provided between the edges of floor slabs and exterior walls, between the tops of walls and the underside of floors, in the control joint in masonry walls and floors and in expansion joints.

E. Smoke-Stopping:
   1. As required by the other Sections, Smoke-Stops shall be provided for Through-Penetrations, Membrane-Penetrations, and Construction Gaps with a material approved and tested for such application.

3.2 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify that environmental conditions are safe and suitable for installation of firestop products.
C. Verify that all pipes, conduit, cable, and other items that penetrate fire-rated construction have been permanently installed prior to installation of firestops.

### 3.3 INSTALLATION

**A. General:**
1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
4. Seal holes and penetrations to ensure an effective smoke seal.
5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
7. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

**B. Dam Construction:**
1. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

### 3.4 FIELD QUALITY CONTROL

**A.** Prepare and install firestopping systems in accordance with manufacturer’s printed instructions and recommendations.

**B.** Follow safety procedures recommended in the Material Safety Data Sheets.

**C.** Finish surfaces of firestopping that are to remain exposed in the completed work to a uniform and level condition.

**D.** All areas of work must be accessible until inspection by the applicable Code Authorities.

**E.** Correct unacceptable firestops and provide additional inspection to verify compliance with this specification.

### 3.5 CLEANING

**A.** Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
B. Leave finished work in a neat and clean condition with no evidence of spillovers or damage to adjacent surfaces.

3.6 IDENTIFICATION

A. Refer to section 27 05 53 for labeling details.

END OF SECTION
PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

   A. Applicable requirements of Division 27 00 00 Communications shall be considered a
      part of this section and shall have the same force as if printed herein full.

   B. This document describes the products and execution requirements relating to
      Communications Termination Blocks & Patch Panels.

   C. Product specifications, general design considerations, and installation guidelines are
      provided in this document. Locations of telecommunications equipment and typical
      installation details will be provided on Drawings as an attachment to this document. If
      the bid documents are in conflict, the Drawings shall take precedence. The successful
      vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

   A. Product data
   B. One (1) sample of each

1.3 WORK INCLUDED

   A. The work included under this Specification consists of furnishing all labor, equipment,
      materials, supplies and performing all operations necessary to complete the
      installation. The Contractor will provide and install all of the required material
      whether specifically addressed in the technical specifications or not.

   B. The work shall include, but not be limited to the following:
      1. Furnish and install all Patch Panels.
      2. Furnish and install all Optical Fiber Enclosures.
      3. Furnish and install all Termination Blocks.

PART 2 – APPROVED PRODUCTS

2.1 PATCH PANELS

   A. Approved 48-port Category 5e Patch Panel manufacture:
      1. Ortronics Part Number: OR-PHD5E8U48
2.2 110 BLOCKS

A. Approved Termination Block manufacture:
   1. Siemon Part Numbers: 100-Pair Unit S110D(X) 1-100RFT
      200-Pair Unit S110D(X) 1-200RFT
      300-Pair Unit S110D(X) 1-300RFT

2.3 OPTICAL FIBER ENCLOSURES

A. Approved 72-Port Optical Enclosure manufacture:
   1. Corning Part Numbers: Enclosure CCH-04U
      Multimode Insert CCH-CP06-E7
      Singlemode Insert CCH-CP06-59

   B. Approved 12-Port Optical Enclosure manufacture:
      1. Corning Part Numbers: Enclosure CCH-01U
         Multimode Insert CCH-CP06-E7
         Singlemode Insert CCH-CP06-59

PART 3 – EXECUTION

3.1 PATCH PANELS

A. 48 Port, Category 5e Voice patch panels:
   1. The Category 5e patch panel shall be compatible with 19" equipment racks,
      cabinets or wall mount brackets.
   2. The Category 5e patch panel shall be equipped with 8-position modular ports
      and shall allow for termination of the T568B wiring scheme.
   3. The Category 5e patch panel shall be equipped with front labeling space to
      facilitate port identification.
   4. The Category 5e patch panel shall be ETL or UL verified in accordance with
      the Category 5e component performance requirements of ANSI/TIA/EIA-568-
      B.2-1.
   5. Category 5e patch panels shall be used to terminate horizontal Voice and Data
      cables.

3.2 OPTICAL FIBER ENCLOSURES

A. 72-Port, Rack Mount Optical Fiber Enclosure
   1. The rack mount optical fiber enclosure shall be equipped with either a swing
      out mechanism or a sliding drawer to access fibers.
   2. The rack mount optical fiber enclosure shall be capable of terminating
      tight-buffered or loose tube optical fiber cables.
   3. The rack mount optical fiber enclosure shall provide for bend radius control
      throughout the panel as well as storage space for slack cabling.
4. The rack mount optical fiber enclosure shall be equipped with optical fiber adapter inserts.
   a. The optical fiber adapter inserts shall accommodate multimode or single mode terminated optical fiber.
   b. The optical fiber adapter inserts shall be compatible with duplex ST connectors.

5. Rack mount optical fiber enclosures shall be used to terminate backbone optical fiber data cabling.

B. 12-Port, Rack Mount Optical Fiber Enclosure
   1. The rack mount optical fiber enclosure shall be equipped with either a swing out mechanism or a sliding drawer to access fibers.
   2. The rack mount optical fiber enclosure shall be capable of terminating tight-buffered or loose tube optical fiber cables.
   3. The rack mount optical fiber enclosure shall provide for bend radius control throughout the panel as well as storage space for slack cabling.
   4. The rack mount optical fiber enclosure shall be equipped with optical fiber adapter inserts.
      a. The optical fiber adapter inserts shall accommodate multimode or single mode terminated optical fiber.
      b. The optical fiber adapter inserts shall be compatible with duplex ST connectors.
   5. Rack mount optical fiber enclosures shall be used to terminate backbone optical fiber data cabling.

3.3 110 BLOCKS

A. Voice type 110 punch-down blocks (General Purpose):
   1. The appropriate number of 110 type connector blocks shall be provided to accommodate all backbone voice cables and campus service provider cables. 110 blocks shall provide connection for 100-pairs (min).
   2. All type 110-connector blocks shall have standoff legs and transparent plastic label holders. 110 type jumper troughs with legs shall be mounted above and below each 110-connector block.

3.4 IDENTIFICATION
   A. Refer to section 27 05 53 for labeling details.

END OF SECTION
SECTION 271123
CABLE MANAGEMENT & TELECOM ROOM LADDER RACK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 00 00 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cable Management & Ladder Rack.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of telecommunications equipment and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

A. Product data.

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

1. The work shall include, but not be limited to the following:
2. Furnish and install all Horizontal Cable Management.
3. Furnish and install all Vertical Cable Management.
4. Furnish and install Ladder Rack System.
5. Furnish and install all Velcro Straps.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers

1. Ortronics/Legrand
2. Chatsworth Products, Inc.
3. Hubbell
4. Panduit
2.2 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal Cable Management
   Superior Modular Part Number: COMB3519
   1. The horizontal wire manager shall be compatible with 19-inch equipment racks and cabinets.
   2. The horizontal cable manager shall provide support for patch cords at the front of the panel.
   3. The horizontal wire manager shall be equipped with management fingers and covers.
   4. The horizontal cable manager shall be 2 rack-units in height.

2.3 CABLE MANAGEMENT - VERTICAL

A. Vertical Cable Management
   Chatsworth Products, Inc. Part Number: 11729-503
   1. The vertical cable manager shall be double-sided.
   2. The vertical cable manager shall provide support for patch cords at the front of the rack and wire management at the rear of the rack.
   3. The vertical cable manager shall be a minimum width of 6".
   4. Vertical Cable Manager Color shall be clear.

2.4 TELECOM ROOM LADDER RACKS

A. Ladder Rack System
   Chatsworth Products, Inc.
   1. See Drawings for ladder rack system details.
   2. The ladder rack system shall be securely mounted with hardware designed for use in ladder rack systems.
   3. End caps shall be installed on the exposed ends of the ladder racks, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
   4. Ladder Rack System color shall be clear.

2.5 VELCRO STRAPS

A. Velcro Straps
   Hallerman Tyton Part Number: 75X180V2
   1. All cables shall be fastened to support structures with Plenum rated Velcro straps.
   2. Velcro Strap color shall be black.

2.6 LADDER RACK DROP-OUT SHIELD

A. Ladder Rack Drop-Out Shield
   Chatsworth Products, Inc. Part Numbers: 12100-712(IN), 12101-701(OUT)
1. Ladder rack drop-out shields used to protect cables as they are routed from ladder rack to equipment rack.

PART 3 – EXECUTION

3.1 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal cable managers shall be installed above and below patch panels in a 2:1 ratio (two horizontal cable manager per patch panel) or as indicated on Drawings.

3.2 CABLE MANAGEMENT - VERTICAL

A. Vertical cable managers shall be installed on both sides of a single equipment rack. Where two (2) or more racks are positioned in a row, vertical cable managers shall be installed between each rack and each end of the row.

3.3 LADDER RACKS

A. Ladder rack system shall be installed straight, level and perpendicular to walls and ceiling slabs.

B. Ladder racks shall be supported at 5' intervals maximum.

C. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete ladder rack system.

D. See Drawings for ladder rack system details.

3.4 VELCRO STRAPS

A. Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Do not over-cinch cables.

3.5 LADDER RACK DROP-OUT SHIELD

A. Install in ladder rack above equipment racks to support cables as they are routed from the ladder rack to the equipment rack.

3.6 IDENTIFICATION

A. Refer to section 27 05 53 for labeling details.

END OF SECTION
PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 00 00 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Rack Mounted Power Strips.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of telecommunications equipment and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

D. Provide one (1) power strip for each free-standing equipment rack designated with active components. See rack elevation drawings.

1.2 SUBMITTALS

A. Provide product data

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install all Power Strips.

PART 2 – PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Power Strip manufacturer(s):
1. Chatsworth Products, Inc.
2. Wiremold/Legrand
3. Ditek
4. Geist
5. ITW Linx

2.2 POWER STRIPS

A. Power Strip
   1. The power strip shall be equipped with a minimum of six (6) 3-prong, 120 VAC outlets, 6' cord and an on/off switch. Outlets shall accept side pole neutral plugs.
   2. The power strip shall be equipped with surge protection with a 20 Amp current limit.
   3. The power strip shall be equipped with a bracket that enables it to be mounted on a 19" rack, cabinet or wall mount bracket without modification.

PART 3 – EXECUTION

3.1 POWER STRIPS

A. Power strips shall be installed as per the requirements specified by the manufacturer's installation guidelines.

B. See Drawings for installation location on rack(s)/cabinet(s).

3.2 IDENTIFICATION

A. Refer to section 27 05 53 for labeling details.

END OF SECTION
SECTION 271300

COMMUNICATIONS BACKBONE CABLING

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. Pathways.
   2. UTP cable.
   3. Cable connecting hardware, patch panels, and cross-connects.

1.3 DEFINITIONS

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
C. EMI: Electromagnetic interference.
D. IDC: Insulation displacement connector.
E. LAN: Local area network.
F. RCDD: Registered Communications Distribution Designer.
G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between Telecommunications rooms in the telecommunications cabling system structures. Cabling system consists of backbone cables, intermediate and main cross-connects mechanical terminations, and patch cables or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects shall be located in Telecommunications rooms. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in ANSI/TIA/EIA-568-B.1, when tested according to test procedures of this standard.
1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   3. Cabling administration drawings and printouts.
   4. Cabling diagrams to show typical cabling schematics including the following:
      b. Patch panels.
      c. Patch cables.
   5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
   6. Ladder rack layout, showing ladder rack route to scale, with relationship between the rack and adjacent structural, electrical, and mechanical elements. Include the following:
      a. Vertical and horizontal offsets and transitions.
      b. Clearances for access above and to side of ladder racks.
      c. Vertical elevation of ladder racks above the floor or bottom of ceiling structure.
      d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for rack and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

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

G. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E-84 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. 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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test each pair of UTP 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. Polyvinyl floor tile shall be in place prior to mounting systems to the floor.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner’s Representatives.

PART 2 - PRODUCTS

2.1 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Chatsworth (CPI)

B. General Frame Requirements:
   1. Equipment Frames: Freestanding, modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   3. Finish: Manufacturer’s standard, baked-polyester clear coat.

C. Floor-Mounted Racks: Modular-type, construction.
   1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.
   2. Baked-polyester clear coat finish.

D. Modular Freestanding Cabinets:
   1. Removable and lockable side panels.
   2. Hinged and lockable front and rear doors.
   3. Adjustable feet for leveling.
   4. Screened ventilation openings in the front and rear door.
5. Cable access provisions in the roof and base.
7. Roof or door mounted, 550-cfm fan with filter.
9. Baked-polyester black powder coat finish.
10. Cabinets keyed alike.

E. Cable Management for Equipment Frames:
1. Metal, with integral wire retaining fingers.
2. Baked-polyester black powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.
5. Horizontal cable managers shall have extended covers to hide patch cables lacing into vertical cable managers.

2.2 UTP FEEDER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Berk-Tek; a Nexans Company
   2. Ortronics, Inc.
   3. CommScope, Inc
   4. Leviton
   5. General Cable
   6. Mohawk
   7. Superior Essex

B. Description: 100-ohm, see Drawings for number of pairs formed into 25-pair binder groups covered with a thermoplastic jacket.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with ANSI/TIA/EIA-568-B.1 for performance specifications.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications, Riser Rated: Type CMR or CMP, complying with UL 1666.

2.3 UTP FEEDER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ortronics
   2. CommScope, Inc
   3. Leviton
   4. Hubbell
   5. Panduit

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be
terminated with connecting hardware of same category or higher. Connectivity solution shall be manufactured by the same company for an end-to-end solution.

C. Connecting Blocks (voice feeder only): 110-style IDC for Category 3. Provide blocks for the number of cables terminated on the block, plus 20 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building feeder cables and permit interconnection between cables.
   1. Number of Terminals per Field: One for each conductor in assigned cables.
   2. Cords are generally available in lengths to 20 feet (6 m) and longer in 24-inch (600-mm) increments.

2.4 IDENTIFICATION PRODUCTS

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

2.5 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to ANSI/TIA/EIA-568-B.1.
B. Factory test UTP cables according to ANSI/TIA/EIA-568-B.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 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service entrance facilities provider with Owner Representative.

3.2 CABING METHODS

A. Cabling Method: Install cables in raceways and ladder racks except within equipment racks and cabinets. Conceal raceway and cables except in unfinished spaces.
   1. Comply with requirements for raceways and boxes specified in Division 27 Section 27 05 28.

B. Cabling Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Cabling 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.
### INSTALLATION OF CABLES

**A. Comply with NECA 1.**

**B. General Requirements for Cabling:**
2. Comply with BICSI ITSIM, Ch. 6, and "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables shall not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. 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.
9. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 25-foot-long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, and "Pulling Cable." Monitor cable pull tensions.

**C. UTP Cable Installation:**
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
3. Do not remove more than 1/2 inch of the outer jacket.

**D. Open-Cable Installation:**
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

**E. Group connecting hardware for cables into separate logical fields.**

**F. Separation from EMI Sources:**
1. Comply with BICSI TDMM and ANSI/TIA/EIA-569-B recommendations for separating unshielded copper voice and data 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:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 12 inches.

3.4 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Through-Penetration Firestop Systems." Comply with ANSI/TIA/EIA-569-B; Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 IDENTIFICATION

A. Identify system components, cabling, and cabling complying with ANSI/TIA/EIA-606-A. Comply with requirements for identification specified.

B. See Division 27 05 53 Section "Identification for Communication Systems" for additional identification requirements. See Evaluations for discussion about ANSI/TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with ANSI/TIA/EIA-606-A.

C. Cable Schedule: Install in a prominent location in each equipment room and cabling 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, backbone pathways and cables, 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 6 inches 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 device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
      a. Individually number cabling conductors connected to terminal strips and identify each cable or cabling group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
      b. Label each unit and field within distribution racks and frames.
   4. Identification within Connector Fields in Equipment Rooms and Cabling Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware.

F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA/EIA 606-A, for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cables, and labeling of components.
   3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
      a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cables and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or
transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.7 WARRANTY

A. The Structured Cabling System shall carry a manufacturer's 25 year product, labor and applications assurance warranty. Manufacturer and Owner Representative shall perform an end-to-end audit on infrastructure prior to releasing warranty.

END OF SECTION
SECTION 27 13 23
COMMUNICATIONS OPTICAL CABLEING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 27 00 00 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Pathways.
   2. 50/125-micrometer, multimode optical fiber cabling.
   3. Optical fiber cable connecting hardware & panels.
   5. 8.3/125-micrometer, single mode optical fiber cabling.

1.3 DEFINITIONS


B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 OPTICAL CABLING DESCRIPTION

A. Optical cabling system shall provide interconnections between Telecommunications rooms in the telecommunications cabling system structures. Cabling system consists of backbone cables, intermediate and main cross-connects and horizontal optical cabling systems to select areas.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Optical cabling system shall comply with transmission standards in ANSI/TIA/EIA-568-B.3, when tested according to test procedures of this standard.
1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Cabling diagrams to show typical cabling schematics including the following:
   b. Patch panels.
   c. Patch cables.
5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
6. Ladder rack layout, showing ladder rack route to scale, with relationship between the rack and adjacent structural, electrical, and mechanical elements. Include the following:
   a. Vertical and horizontal offsets and transitions.
   b. Clearances for access above and to side of ladder racks.
   c. Vertical elevation of ladder racks above the floor or bottom of ceiling structure.
   d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for rack and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

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

G. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E-84 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. 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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
   2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

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. Polyvinyl floor tile shall be in place prior to mounting systems to the floor.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's Representatives.

PART 2 - PRODUCTS

2.1 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Chatsworth (CPI)

B. General Frame Requirements:
   1. Equipment Frames: Freestanding, modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   3. Finish: Manufacturer's standard, baked-polyester clear coat.

C. Floor-Mounted Racks: Modular-type, construction.
   1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.
   2. Baked-polyester black powder coat finish.
D. Modular Freestanding Cabinets:
   1. Removable and lockable side panels.
   2. Hinged and lockable front and rear doors.
   3. Adjustable feet for leveling.
   4. Screened ventilation openings in the front and rear door.
   5. Cable access provisions in the roof and base.
   7. Roof or door mounted, 550-cfm fan with filter.
   9. Baked-polyester black powder coat finish.
  10. Cabinets keyed alike.

E. Cable Management for Equipment Frames:
   1. Metal, with integral wire retaining fingers.
   2. Baked-polyester black powder coat finish.
   3. Vertical cable management panels shall have front and rear channels, with covers.
   4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.
   5. Horizontal cable managers shall have extended covers to hide patch cables lacing into vertical cable managers.

2.2 OPTICAL FIBER CABLE

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

B. Description: Multimode, “OM-3” 50/125-micrometer, laser optimized, number of strands as shown on drawings, nonconductive dielectric, 900 UM tight buffered, optical fiber cable.
   1. Comply with ICEA S-83-596 for mechanical properties.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
      a. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
   5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
      Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
   6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
   7. Effective Modal Bandwidth (EMB) of 2000 MHz-km.
   8. Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-51 or 30, performed at 23 degrees Celsius + 5 degrees.
   9. Bandwidth: 200 MHZ – km @ 850 nm; 800 MHZ – km @ 1300 nm.
   10. Must be capable of providing serial Gigabit Ethernet for distances up to 500 m at 850 nm & 1000 m at 1300 nm.

C. Description: Single mode, 8.3/125-micrometer, number of strands as shown on drawings, nonconductive dielectric, 900 UM tight buffered, optical fiber cable.
1. Comply with ICEA S-83-596 for mechanical properties.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
   a. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
5. Maximum Attenuation: 0.5 dB/km at 1310 nm and 0.5 dB/km at 1550 nm.
6. Mode Field Diameter: Between 8 and 10 microns, +10%.
8. Cut-off wavelength shall be less than 1279 nm measured in accordance with ANSI/TIA/EIA-455-170.
9. Individual fiber tube colors per ANSI/TIA/EIA-606-A.
10. Must be capable of providing serial Gigabit Ethernet for distances up to 5000 m at 1310 nm.
11. Cables must be designed for outdoor use and provided with water blocking to prevent water penetration.

D. Jacket:
   2. Cable cordage jacket, fiber, unit, and group color shall be according to ANSI/TIA/EIA-598-B.
   3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.3 OPTICAL FIBER CABLE HARDWARE

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

B. Cross-Connects and Patch Panels: Fiber panels shall be available in 1RU, 2RU and 4RU versions. Multi-mode and single mode fibers shall be terminated in separate enclosures.

C. Coordinate subparagraph below with Drawings for quantity of fields.
   1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

D. Cable Connecting Hardware:
   2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.5 dB, with typical insertion loss of 01 dB. Minimum return loss of 20 dB.
   3. Type SFF connectors may be used in termination racks, panels, and equipment packages.
4. The connector shall have optical axial pull strength at 2.2N at 0 degree angle and 2.2N at 90 degree angle, with a maximum 0.5 dB increase in attenuation in accordance with ANSI/TIA/EIA-455-6B.

E. Splice Enclosure:
   1. Fiber optic splice enclosures shall be designed for splicing fibers in a below ground and buried application. End caps shall be sealed and enclosure to be provided with all required fiber management provisions.
   2. Fiber enclosures to be sized to accommodate required quantity of fiber splices. All splices to be fusion type.
   3. Fiber enclosures to be typical to Corning Model #SCF Series enclosures.

### 2.4 IDENTIFICATION PRODUCTS

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

### 2.5 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to ANSI/TIA/EIA-568-B.1.

B. Factory test UTP cables according to ANSI/TIA/EIA-568-B.2.

C. Factory test optical fiber cables according to ANSI/TIA/EIA-526-14-A and ANSI/TIA/EIA-568-B.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Optical fiber cable strands shall be tested using an OTDR. Test results shall conform to ANSI/TIA/EIA-526-7 for single mode and ANSI/TIA/EIA-526-14A for multimode.

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### PART 3 - EXECUTION

#### 3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service entrance facilities provider with Owner.

#### 3.2 CABLING METHODS

A. Cabling Method: Install cables in raceways and ladder racks except within equipment racks and cabinets. Conceal raceway and cables except in unfinished spaces.
   1. Comply with requirements for raceways and boxes specified in Division 26.

B. Cabling Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
C. Cabling 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.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   2. Comply with BICSI ITSIM, Ch. 6, and “Cable Termination Practices.”
   3. Install 110-style IDC termination hardware unless otherwise indicated.
   4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   5. Cables shall not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
   8. 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.
   9. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
   10. In the communications equipment room, install a 25-foot-long service loop on each end of cable.
   11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, and “Pulling Cable.” Monitor cable pull tensions.

C. Optical Fiber Cable Installation:
   2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

D. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:
1. Comply with BICSI TDMM and ANSI/TIA/EIA-569-B recommendations for separating unshielded copper voice and data 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:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 12 inches.

3.4 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Through-Penetration Firestop Systems." Comply with ANSI/TIA/EIA-569-B; Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

C. Comply with the State of Georgia Telecommunications Distribution Manual, Firestopping sections.

3.5 IDENTIFICATION

A. Identify system components, cabling, and cabling complying with ANSI/TIA/EIA-606-A. Comply with requirements for identification specified.

B. See Division 27 05 53 Section "Identification for Communication Systems" for additional identification requirements. See Evaluations for discussion about
ANSI/TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with ANSI/TIA/EIA-606-A.

C. Cable Schedule: Install in a prominent location in each equipment room and cabling 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, backbone pathways and cables, 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 6 inches 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 device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
      a. Individually number cabling conductors connected to terminal strips and identify each cable or cabling group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
      b. Label each unit and field within distribution racks and frames.
   4. Identification within Connector Fields in Equipment Rooms and Cabling Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware.

F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA/EIA 606-A, for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cables, and labeling of components.

C. General Fiber Testing Requirements:
   1. Multimode
a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter / light source. Fiber must be tested at both 850nm and 1300nm.

b. Maximum attenuation dB/Km @ 850nm/1300nm shall be 3.0/1.5.

c. Maximum attenuation per connector pair shall be .75 dB.

2. Single Mode

a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter / light source. Fiber must be tested at both 1310nm and 1550nm.

b. Maximum attenuation dB/Km @ 1310nm/1550nm shall be 0.4/0.3 for outside plant and 0.65/0.50 for inside plant.

c. Maximum attenuation per connector pair shall be .75 dB.

3. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA/EIA-568-B. Use only test cables and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

b. Link End-to-End Attenuation Tests:
   i. Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to ANSI/TIA/EIA-526-14-A, Method B, One Reference Jumper.
   ii. Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in ANSI/TIA/EIA-568-B.1.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 WARRANTY

A. The Structured Cabling System shall carry a manufacturer's 25 year product, labor and applications assurance warranty. Manufacturer and RCDD shall perform an end-to-end audit on infrastructure prior to releasing warranty.

END OF SECTION
SECTION 271333

CATV DISTRIBUTION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 00 00 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to the CATV Distribution System.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of horizontal cabling and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

A. Contractor shall provide submittals indicating the following:
   1. Cable description
   2. CATV Components
   3. Product data
   4. Testing and qualification data
   5. Samples, approximately 12” in length

1.3 WORK INCLUDED

A. This section of the Specifications requires the complete installation of the Television Signal Distribution System (TSDS) for the reception, amplification, and reproductions of television channels as indicated on the drawings and/or specified herein. Provide all labor, materials, equipment and supervision to install, check out, adjust and calibrate total system.

B. Reference one-line diagram in contract documents and floor plan drawings for complete requirements.

C. The work shall consist of the installation of a complete television signal distribution system consisting essentially of, but not limited to, the following major components:
   1. Terminating Devices.
   2. System Wiring.

1.4 QUALITY CRITERIA & STANDARDS
A. CATV wiring, devices, and equipment shall comply with applicable UL, NEC, and NEMA standards and requirements and shall be UL-listed and labeled.

B. CATV wiring systems shall conform to established trade and industry standards.

1.5 CONTRACTOR REQUIREMENTS

A. The Contractor must be licensed in the State of Georgia as a Low Voltage Telecommunications (LV-T) or Low Voltage Unlimited (LV-U) class certification.

B. Contractor shall have a minimum of three (5) year experience of installing, terminating, and testing CATV wiring systems. If requested, the Contractor must show proof of being in the CATV installation trade for a minimum of five years and provide three (3) references with contact names and telephone numbers regarding successful completion of CATV wiring projects.

PART 2 – PRODUCTS

2.1 CATV STATION JACKS, FACEPLATES, AND ASSOCIATED COMPONENTS

A. Station jacks shall be female F-connectors supporting SUB/VHF/UHF frequency bands. See 2.03 below.

B. Only one color and one manufacturer of station jacks and coverplates shall be used throughout the project.

C. Faceplates shall be modular and shall be able to accept RJ-45, coax F connectors, and/or fiber ST connectors. Faceplates shall provide sloped modules - All outlet jacks shall angle down 45 degrees.

D. Blank inserts shall be used in faceplates with less than maximum amount of jacks installed.

E. The contractor shall be responsible for coordinating the location of the TSDS jacks with TV mounts.

F. Connectors shall meet the following requirements:
   1. RG-6 - “PCT-P”
   2. RG-11 compression type
   3. ½” Trunk coax – ½” hard line connectors.

2.2 CATV STATION AND DISTRIBUTION CABLE

A. RG-6/U 18 AWG, 75 Ohm, quadshield, plenum-rated cable with a copper covered steel center conductor. Cable shall be capable of 5-1000 MHz. RG-6/U cable shield construction shall have 2 Foils + 2-60% AL and a nominal DCR of 5.3 Ohms per 1000’. RG-6/U shall be used for station drops to 200’. For all drops with cabling lengths exceeded 200 feet, contractor to provide RG-11U cable.
B. RG-11/U 14 AWG, 75 Ohm, quadshield, plenum-rated cable with a copper covered steel center conductor. Cable shall be capable of 5-750 MHz. RG-11/U cable shield construction shall have 2 Foils + 60% AL 40% AL and a nominal DCR of 3.7 Ohms per 1000'. RG-11/U shall be used for station drops from 200' to 300' and for backbone distribution.

C. Long Distance Indoor Backbone Cable - .500” plenum rated distribution cable, 75 Ohm, with a copper clad aluminum center conductor. Cable shall be capable of 5-1000 MHz. Cable shall be rated and labeled for plenum installation. Cable shall be CommScope Model #2312K or equal.

D. All CATV cables shall be tested. All cable lengths shall be noted and indicated on each label affixed to each end of each cable. The length of each cable shall be recorded and included with test reporting.

2.3 CATV STATION AND DISTRIBUTION CONNECTORS

A. Station connectors shall be one piece, hex-crimp F-connectors to be used with quadshield cable and shall be installed with a tool specifically designed for the make and model of cable and connector used. No twist-on connectors are permitted.

B. Distribution connectors shall be three piece shielded type connectors and shall be installed with stripping, cutting, and coring tools specifically designed for the make and model of cable and connector used.

2.4 EQUIPMENT CABLES

A. The contractor shall provide one (1) 2-meter RG-6U or RG-11U patch cable for each CATV jack.

2.5 CATV DISTRIBUTION ACTIVE AND PASSIVE ELECTRONIC COMPONENTS

A. All CATV distribution active and passive electronic components shall be capable of operating in the 5-750MHz (minimum) bandwidth. 1GHz electronic components are acceptable.

B. All CATV distribution active and passive electronic components shall be capable of two-way signal operation.

2.6 AMPLIFIERS

A. The broadband amplifier shall be of solid state design with a bandwidth of 47 to 750 MHz. Amplifier shall be CATV compatible with an adjustable gain capacity of 31dB. Manual slope control range shall be 10dB. All terminal impedances shall be 75 ohm. Output shall be 44dBmV per channel for 48 channels. Power supply voltage shall be 120 VAC. An output test jack shall be provided for in-service testing.

2.7 ATTENUATORS

A. Attenuator shall be variable type and provide any increment of attenuation up to 18 dB for signals between 54 and 900 MHz. Specifications include:
1. Frequency Range: DC-900 MHz
2. Impedance: 75 ohms
3. Attenuation Range: 18 dB

2.8 MIXER/SPLITTER DEVICES

A. Broadband mixing and splitting devices shall be equipped with flanges for mounting on any flat surface. Units shall meet FCC Specifications on radiation. The devices shall be installed in the headend equipment rack or in screw cover junction boxes.

B. All units shall have a frequency response from 54MHz to 806MHz. Two-way splitters shall have a maximum splitting loss of 3.8dB. Four-way splitters shall have a maximum splitting loss of 7.7dB. Directional coupler taps shall have nominal tap loss values of 8, 12, 16, 20, and 24dB. Return loss at any treatment shall be 18dB or better. Insertion loss shall not exceed 1.1dB.

C. Multi-port directional taps shall be available with two, four, and eight taps in addition to the feed through ports. Taps shall be available with the following tap loss characteristics expressed in nominal dB: 10, 14, 17, 20, 23, 26, 29, 32, 35, 38 and 41 dB. Tap to top isolation shall be 30dB minimum from 5 to 10 MHz. Match shall be 20dB minimum return loss input to taps for 10 to 300 MHz. Multiport directional taps shall be installed in equipment enclosures above ceiling. Install bushings to protect entrance and exit of feeder coaxial cables.

2.9 TERMINATING DEVICES

2.10 Terminating resistors with 75 ohm impedance shall be installed at all unused ports and feeder line ends. Terminating resistors shall be provided to cover the frequency range from 54MHz to 216MHz and 470 to 890MHz with minimum return loss of 30dB from 5MHZ to 300MHz and 25dB from 470MHz to 890MHz.

2.11 EQUIPMENT HOUSINGS

A. Equipment housing shall be provided to protect and mount headend equipment. The housing shall be manufactured of 16 gauge steel and be finished in gray enamel. The removable cover shall be equipped with a louvered metal front for ventilation, handles for removal and provisions for locking the housing.

1. The housing shall provide for vertical mounting of standard 19” rack width equipment. Mounting rails shall be drilled and tapped to provide 5” of front and rear clearance for equipment. Knockouts shall be provided for power entrance and coaxial cables. Nominal dimensions shall be 21” wide x 12” deep.

2. Equipment housing shall be installed where shown on the drawings with bottom of housing 48” above floor. Size housing as required by equipment.

2.12 MANUFACTURERS

A. Acceptable manufacturers of CATV station jacks, faceplates, and associated components are:

1. Hubbell
2. Panduit
3. Ortronics  
4. AMP  
5. Blonder Tongue

B. Acceptable manufacturers of RG-6/U, RG-11/U, and .500 CATV station and distribution cables are:
   1. Belden  
   2. Comm/Scope  
   3. Times Fiber

C. Acceptable manufacturers of CATV bulkhead patch panels, wire management, and associated components are:
   1. Ortronics  
   2. Concap  
   3. Hubbell  
   4. AMP

D. Acceptable manufacturers of CATV station and distribution connectors and associated components are:
   1. Gilbert  
   2. PPC  
   3. Blonder Tongue

E. Acceptable manufacturers of CATV distribution active and passive electronic components are:
   1. Scientific Atlanta  
   2. Exide Electronics  
   3. General Instrument  
   4. Blonder Tongue

PART 3 – EXECUTION

3.1 INSTALLATION OF CATV STATION JACKS AND FACEPLATES

A. CATV station jacks and faceplates shall be installed per manufacturer’s written instructions.

B. The cables shall be installed in faceplate so that mechanical strain does not degrade the connection.

C. The contractor shall be responsible for coordinating the location of the TSDS jacks with TV mounts. Reference architectural drawings for exact locations.

3.2 INSTALLATION OF CATV STATION CABLE

A. CATV station cable shall be installed per manufacturer’s written instructions. Do not exceed the minimum bend radius (per the manufacturer’s cable specifications) during installation.
B. See Horizontal Cabling Section of specifications for complete requirements.

C. The cable shall not be compressed, crimped, crushed, or stretched. The cable jacket shall not be cut or damaged in any way which would expose the inside wire.

D. Protection shall be provided against sharp edges or possible damage caused by work done in the vicinity of the cable. Cable routing shall follow the dictates of the design while avoiding of adverse environmental conditions.

E. Tag each end of all cables with the room numbers.

F. Cables shall be place on termination panel in ascending room order starting with the room having the lowest number and ending with the room with the highest number. Label with room numbers.

3.3 COAXIAL WIRING TESTS

A. Contractor shall provide all necessary testing equipment to test all cables.
   1. Each cable shall be tested from each end to determine length, continuity, and that all connectors have been properly made.
   2. The contractor shall test all station cables with a Time Domain Reflectometer (TDR). TDR shall be supplied by the contractor.

B. A hard copy of the test results shall be submitted for review to the owner's Project Superintendent in notebook format. Test report data shall reference cables by cable labeling standards.

3.4 AS-BUILT DRAWINGS AND/OR DOCUMENTATION

A. As-built drawings shall be required (owner's blueprints may be used for this purpose) noting the exact cable patch and cable labeling information.

3.5 SYSTEM ACCEPTANCE

A. Before the system is accepted by owner, the contractor shall be required to walk-through the installation with the owner's representative and the design engineer to verify proper installation. The contractor may be requested to pull faceplates to verify cable labeling and/or installation compliance.

END OF SECTION
SECTION 271500
COPPER HORIZONTAL CABLING

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 270000 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Structured Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of horizontal cabling and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

A. Contractor shall provide submittals indicating the following:
   1. Cable description
   2. Use of cable
   3. Product data
   4. Specifications outlining cable
   5. Testing and qualification data
   6. Samples, approximately 12” in length

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Horizontal Copper Cable.

PART 2 – PRODUCTS

2.1 HORIZONTAL DATA COPPER CABLE

A. CATEGORY 6 BALANCED TWISTED PAIR CABLE
1. The horizontal balanced twisted pair cable shall be swept tested to 350 MHz and meet the performance limits listed in ANSI/TIA/EIA-568-B.2-1.
2. The horizontal balanced twisted pair cable shall meet or exceed the Category 6 transmission characteristics per ANSI/TIA/EIA-568-B-1.
3. Cable jacket shall be CMP (plenum) rated.
4. Jacket color shall be BLUE for designated data circuits.

2.2 HORIZONTAL VOICE COPPER CABLE

A. CATEGORY 5e BALANCED TWISTED PAIR CABLE
   1. The horizontal balanced twisted pair cable shall be swept tested to 250 MHz and meet the performance limits listed in ANSI/TIA/EIA-568B.2-1.
   2. The horizontal balanced twisted pair cable shall meet or exceed the Category 5e transmission characteristics per ANSI/TIA/EIA-568-B-1.
   3. Cable jacket shall be CMP (plenum) rated.
   4. Jacket color shall be WHITE for Voice and GREEN for Data designated circuits.

2.3 UTP FEEDER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Berk-Tek; a Nexans Company

B. Description: 100-ohm, see Drawings for number of pairs formed into 25-pair binder groups covered with a thermoplastic jacket. Cables to be plenum-rated.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with ANSI/TIA/EIA-568-B.1 for performance specifications.
   3. Comply with ANSI/TIA/EIA-568-B.2 for category transmission requirements.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications, Riser Rated: Type CMR or CMP, complying with UL 1666.

PART 3 – EXECUTION

3.1 HORIZONTAL CABLES

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points. Maximum cable length will not exceed 295 feet.
E. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

G. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

H. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

I. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

J. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

K. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.1 document, manufacturer's recommendations and best industry practices.

L. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

M. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

N. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support straps. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.2 IDENTIFICATION

A. Refer to section 27 05 53 for labeling details.

END OF SECTION
SECTION 271543
FACEPLATES & CONNECTORS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 270000 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Faceplates & Connectors.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of horizontal cabling and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

1.2 SUBMITTALS

A. Provide the following submittals:
   1. Product data
   2. Sample of each outlet correctly configured.

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
   1. Furnish and install all Copper Connectivity.
   2. Furnish and install all Faceplates.
   3. Furnish and install all Surface Mount Boxes.

PART 2 – PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Copper Connectivity Manufacture
   1. Ortronics Series II                         Part Number: OR-S225E00-88

B. Approved Faceplate Manufacture
   1. Ortronics Series II                        Part Number: OR-40300158
C. Approved Surface Box Manufacture
   1. Ortronics Series II Part Number: OR-40400031

2.2 COPPER CONNECTIVITY

A. Horizontal Module
   1. The horizontal module shall accommodate up to four (4) Category 6, 8-position, 8-contact modular jacks or four (4) Category 5e, 8-position, 8-contact modular jacks.
   2. Each data jack shall be ETL or UL Verified in accordance with the Cat-6 component performance requirements of ANSI/TIA/EIA-568-B.2-1. Voice jacks shall be ETL or UL Verified in accordance with the Cat-5e component performance requirements of ANSI/TIA/EIA-568-B.2.
   3. Each jack shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
   4. The connector module shall be designed for use at the Work Area, Telecommunications Room and/or Equipment Room without modification.
   5. Each jack shall be T568B wiring configuration.
   6. Each jack shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
   7. Module color shall be white.

2.3 FACEPLATES

A. Faceplates
   1. The faceplate housing the connector modules shall have no visible mounting screws.
   2. It shall be possible to install the connector modules in wall-mounted single-gang electrical boxes, utility poles and modular furniture (cubicle) access points using manufacturer-supplied faceplates and/or adapters.
   3. The faceplate housing the connector modules shall have the option of being mounted on adapter boxes for surface mount installation.
   4. The faceplate housing the connector modules shall have a labeling capability using built-in labeling windows to facilitate outlet identification and ease network management.
   5. The faceplate housing the connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present of future network needs.
   6. Color shall be office white.

B. Sloped Modules
   1. All outlet jacks shall angle down 45 degrees.

C. Blank Insert
   1. Color shall be office white.

D. Icons
   1. Voice will be White, Data will be Blue

2.4 SURFACE MOUNT BOXES
A. The surface mount box shall accommodate horizontal and video connections.

B. The surface mount box shall have internal storage space for slack cabling and a built-in spool for controlling cable bend radius.

C. Color shall be office white.

PART 3 – EXECUTION

3.1 COPPER CONNECTIVITY

A. 8-position, 8-contact modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

3.2 FACEPLATES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.

C. Faceplates shall be installed straight and level.

D. Faceplates shall be installed at heights as noted on the Drawings.

3.3 SURFACE MOUNT BOXES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.

C. Surface mount boxes shall be installed straight and level.

D. Surface mount shall be installed at heights as noted on the Drawings.

3.4 IDENTIFICATION

A. Refer to section 27 05 53 for labeling details.

END OF SECTION