



Facilities Design and Construction Services

Architectural and Engineering Design Standards

January 2023

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OVERVIEW

Intent

Any design and construction project, be it new, partial or full renovation, is a comprehensive and integrative undertaking. It requires a collaborative effort on the part of a team that, in its most expansive form, includes the Design Professional, the Contractor, and the Institution's staff. Given the complexity of 21st Century campuses for higher education, it is important to establish guidelines for the product as well as the process associated with any project. The intent of this document is to provide specific guidelines to architects, engineers, design consultants and contractors for all construction activities at Georgia State University.

About Georgia State University

Established in 1913, Georgia State University is the largest of the 26 Institutions that make up the University System of Georgia. Located in the heart of downtown Atlanta, this major research university has more than 54,000 students seeking degrees. Students come from every county in Georgia, every state in the nation and from over 160 countries.

Georgia State University is a national leader in graduating students from widely diverse backgrounds. The university offers 250 undergraduate and graduate degree programs in more than 100 fields of study in its nine colleges and schools.

Organization and Administration of Document

Facilities Design and Construction Services carries the primary responsibility for initiating, using, enforcing and updating this document. They work in collaboration with other units within the institution as they use it to deliver a successful design and construction project.

The first sections address overall intent and general requirements related to the process. These are followed by Divisions that contain more specific information and reflect those divisions found in the standard Construction Specifications Institute's (CSI) expanded format. These are not intended to be full specifications but rather to provide content and guidance regarding those key parameters and requirements that must be incorporated in the design and construction process. These standards are intended to summarize information that is unique to Georgia State University and to avoid historical problems with construction, operations and maintenance. Designers and contractors shall become familiar with and are responsible for all sections of the Standards, and are to incorporate the information early in the design and construction process.

These guidelines do not stand alone but rather relate and incorporate the requirements of the Board of Regents of the University System of Georgia and the Georgia State Financing and Investment Commission. They supplement and augment these requirements by providing information that is specific to the manner in which design and construction should be executed at any GSU location. However, they do not replace the rigor of professional analysis and responsibility. The Design Professional shall conduct independent evaluations, discuss alternatives and recommendations with the GSU Project Manager.



General Design Criteria

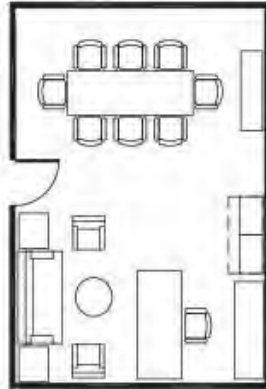
Space Guidelines:

General overall layout of rooms, corridors and facilities shall provide maximum flexibility and access for routine maintenance. The following approximate minimum office square footages shall be taken into consideration during Programming:

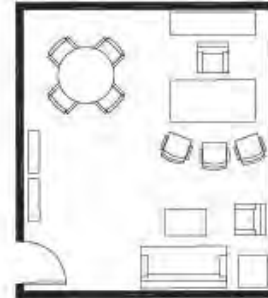
President	450 SF
Provost	350 SF
Vice President / Dean	300 SF
Assistant / Associate Provost	180 SF
Assistant / Associate Dean	
Assistant Vice President	
Chair / Director / Department Head	
Assistant / Associate Director	150 SF
Assistant Chair	
Assistant Department Head	
Manager	
Head Coach	
Faculty / Professor	120 SF
Assistant / Associate Professor	
Assistant Manager	
Visitor / Part-Time Faculty	120 SF
Emeritus Office	100 SF
Open Office (Managerial)	96 SF
Open Office (Special Equip Needs)	80 SF
Open Office (Standard)	64 SF
Open Office (Shared)	64 SF
Open Office (GRA / Student Assistant)	45 SF
Reception (1 Person)	45 to 64 SF
Reception (2 Persons)	90 to 135 SF
Reception Seating (2 to 6 Persons)	36 to 108 SF
Conference Rooms (4 to 18 Persons)	120 to 450 SF

Typical Office and Workstation Layouts:

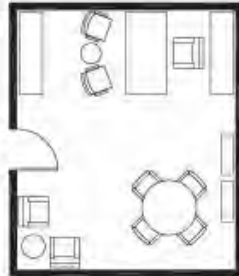
PO - 1
PRESIDENT
450 SQ. FT



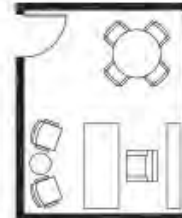
PO - 2
PROVOST
350 SQ. FT



PO - 3
VP/DEAN
300 SQ. FT



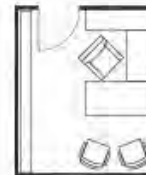
PO - 4
PROVOST/DEAN
(ASSOC. & ASSIST.)
180 SQ. FT



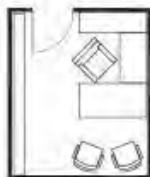
PO - 5
DIRECTOR/HEAD
(ASSOC. & ASSIST.);
DEPT. HEAD
150 SQ. FT



PO - 6
FACULTY/PROFESSIONAL
120 SQ. FT



PO - 7
SHARED FACULTY/
PROFESSIONAL
120 SQ. FT



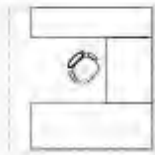
PO - 8
ADMINISTRATION
100 SQ. FT





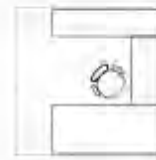
OS - 1

ADMINISTRATIVE
(CUBICLE)
96 SQ. FT



OS - 2

TECHNICAL STAFF
(CUBICLE)
80 SQ. FT



OS - 3

CLERICAL/GRAD STUD
(CUBICLE)
64 SQ. FT



OS - 4

STUDENT DESK
45 SQ. FT



Design Phase Considerations:

The Consultant shall provide site visits as needed to record existing conditions.

All CAD floor and building plans provided by GSU shall be used for reference purposes only. The Consultant is responsible for field-verifying all existing dimensions and conditions prior to preparing and submitting drawings.

Drawings:

Generally, the Consulting firm shall provide the following drawings as a minimum:

- Site / Building Plans
- Demolition Plans
- Dimensioned Partition Plans
- Furniture Plans
- Reflected Ceiling Plans
- Fire Protection Plans
- Plumbing Plans
- Mechanical Plans
- Power and Lighting Plans
- Low Voltage Plans
- Millwork Details
- Interior Elevations
- Schedules – Door & Hardware and Finish

All drawings shall use the GSU project number and project name. Both the GSU project number and project name shall be on the bottom right corner of each drawing sheet. Provide GSU logo at top right corner of plans.



Room numbers for plans must be as provided by the GSU Project Manager. Establish space numbering prior to preliminary design review.

Provide North arrows on all floor plans. Provide Key Map/Plans to show the location of the work.

Specifications:

Generally, the Consulting firm shall prepare specifications in book format.

Finishes:

All proposed finish and furniture selections will be submitted to and approved by the GSU Project Manager and Interior Design Specialist. The 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. The Consultant shall review all finish and material palettes/selections with the GSU Project Manager prior to presentation to the end user. The Consultant shall take care to minimize the use of light-color and solid upholstery and carpet selections.

Close-out Documents:

Record Documents:

Record Drawings: Provide Contract Drawings and Shop Drawings. Show the actual installation where installation varies from that shown originally. Particular attention must be given to information on concealed elements that cannot be readily identified and recorded later. Clearly indicate all changes to the drawings. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable. All changes during construction must be updated on original construction drawings in electronic format. The updated drawings must be provided in AutoCad dwg format. Provide one digital copy on a flash drive.

Record Specifications: Provide Project's Specifications, including addenda and contract modifications. Mark copies to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Provide one digital copy on a flash drive.

Record Product Data: Provide Product Data submittal. Mark sets to indicate the actual product installation where installation varies substantially from that indicated in Product Data. Provide one digital copy on a flash drive.

Operation and Maintenance Manuals: Provide operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Provide one digital copy on a flash drive.

Warranties: Provide warranties in an orderly sequence based on the table of contents of the Project Manual.

Record Finishes: Submit one binder containing material samples and colors of all finishes used on the Project.



Codes:

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

END OF SECTION



DIVISION 01 00 00 – GENERAL REQUIREMENTS

Site Requirements

Street and parking lot layouts shall comply with standards of the County or Municipality in which the project is located.

Specify traffic pavement type for specific soil conditions and anticipated loading. Use Georgia Department of Transportation standard pavement details and specifications. GSU, site conditions allowing, has a preference for permeable pavement.

Design drainage structures and surface runoff to remove water efficiently from the site. Ponding in storm water structures is unacceptable.

Adequate surface drainage shall be provided in all areas. A minimum slope of 1% shall be maintained.

Surface water shall not be permitted to flow over retaining walls.

Soil conditions shall be tested by a licensed professional geo-technical engineer. Foundations shall be designed in accordance with the engineer's recommendations. A copy of the soils report shall be delivered to the GSU Project Manager.

Curb ramps shall be provided for the physically disabled in compliance with the Americans with Disabilities Act. Tactile warning surfaces shall be as follows:

Downtown Campus:	Match the City of Atlanta Standards
Alpharetta Campus:	Hanover Tactile Pavers, truncated domes, tudor/charcoal
Dunwoody Campus:	Hanover Tactile Pavers, truncated domes, tudor/charcoal
Clarkston Campus:	Hanover Tactile Pavers, truncated domes, tudor/charcoal
Decatur Campus:	Hanover Tactile Pavers, truncated domes, tudor/charcoal
Newton Campus:	Hanover Tactile Pavers, truncated domes, tudor/charcoal

Termite treatment shall be provided for all new buildings and additions to buildings and shall be supplied with a five (5) year warranty with optional annual renewal.

Provide minimum of two 4" diameter or larger Schedule 40 PVC pipes crossing under walks for future use in running utilities and irrigation lines. Ductile iron pipe shall be used for crossing under drives. No. 4 rebar shall mark the end of each PVC pipe.

Provide bollards to protect loading docks and driveways that are located next to building. The bollards shall protect the building, dock, utilities, or other structures that could be damaged by vehicles.

In general, exterior sewer pipe shall be PVC. Ductile iron, concrete lined, shall be used under streets and drives.

Architectural screens shall be provided around all exterior mechanical equipment.



Quazite pull boxes, where required for electrical infrastructure, shall be a minimum of 16" x 24".

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

Roof Requirements:

Roofing Systems shall be designed with a minimum slope of $\frac{1}{4}$ " per foot. Wherever possible, this shall be accomplished by sloping the basic roof structure.

Emergency overflow protection shall be provided for all roofs having internal drain systems.

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

Drains shall be provided at all canopies.

Non-curb mounted HVAC equipment shall be set on frames a minimum of 24" clear above the roof level.

Project Budget permitting, provide a parapet wall around the perimeter of the roof, at a minimum of 42" above roof level.

No public access shall be provided to the roof from occupied floors.

Toilet Rooms:

Restroom doors shall swing out from the restrooms.

Toilet Rooms shall be designed such that no fixture may be seen with the entrance door open 90°.

Mechanical Rooms:

Mechanical rooms should not be located next to sound sensitive spaces. Locate high voltage transformers as far from office and classroom space (including above and below) as practical. Walls, floors, and ceilings between mechanical rooms and occupied spaces must have a STC rating in excess of 60 at all audible frequencies, and shall be free of vibration. The Consultant is encouraged to locate storage, service, and toilet rooms as a buffer between mechanical rooms and occupied spaces. Where possible, provide an outside door to mechanical rooms and boiler rooms.

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



Finishes:

Acoustical design should be considered in appropriate areas for comfort, presentations, and privacy.

Flooring for common areas and lobbies shall use durable materials such as stone or tile. Generally, flooring for Classrooms shall be VCT.

For future maintenance purposes, limit the use of inaccessible ceiling systems.

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

Building Structure:

Georgia State University prefers concrete frame structures as opposed to steel framed structures. Design consultants can propose steel framed structures for design or cost considerations.

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 light weight concrete.

Roof and Floor Loads shall not be supported by load bearing masonry walls, with the exception of small one-story utility buildings which have been designed in accordance with the "Recommended Practice for Engineered Brick Masonry" and the "Specifications for Design and Construction of Load Bearing Concrete Masonry".

The Consultant shall use Due Care to provide expansion provisions for building structures, masonry materials, metals and similar applications.

General Considerations:

All construction materials proposed for new construction or renovation projects shall not contain asbestos.

Skylights shall be avoided. Design may include clerestories or lanterns.

Hose Bibbs shall be provided on the exterior of buildings at no more than 75' apart around the entire building perimeter.

Provide a minimum of 6" of clear space in plumbing chases. Provide a greater width where possible.

Design shall be as such to avoid galvanic action between dissimilar metals.

Floor penetrations in upper floors shall be provided with a 2" high pipe sleeve sealed to the floor slab and surrounded by a stainless steel dam sealed to the floor slab – refer to the photo below:



Commissioning:

The University, as part of the State of Georgia, expects all projects to incorporate the requirements of the Energy Efficiency and Sustainability Construction Act of 2008 ("PEACH"). Commissioning activities must be pursued.

- As a minimum - Commissioning of the following systems must be performed: mechanical, electrical, access controls, and building envelope.
- PEACH Basic Commissioning requirements must be met.
- University staff must witness and participate in the commissioning activities.
- Test & Balance (T&B) is required on all projects. In the case of renovations, before and after.

END OF SECTION

DIVISION 02 00 00 – EXISTING CONDITIONS



General

All existing exterior and interior conditions not noted for demolition, improvement, or part of the scope of work in any way, shall be protected during the work to prevent damage and if damaged during the course of the work shall be restored to its original condition.

All damaged work shall be repaired by the Contractor at his own expense. If GSU elects to make the necessary repairs with GSU work forces, the Contractor shall reimburse GSU for the cost of such repairs.

The Contractor shall document with photos and videos all existing conditions of the project site and submit a copy to the GSU Project Manager.

The Contractor shall document the condition and operation of all existing equipment to remain.

All materials, equipment, services that were active at the beginning of the project and that will no longer be in service at the end shall be removed from the site. Abandoned infrastructure must be removed.

The Design Professional shall catalog the re-use of materials and equipment by noting in the design documents what is to be salvaged, re-used on site or re-used off site.

END OF SECTION

DIVISION 03 00 00 – CONCRETE



General:

Concrete design shall meet or exceed American Concrete Institute (ACI) Standards. Structural drawings shall be sealed by a registered structural engineer in the State of Georgia.

Concrete Formwork:

Formwork shall be designed by a professional engineer registered in the State of Georgia. Material shall have sufficient strength to resist deflection in excess of allowable tolerances.

Materials:

Generally, all Portland Cement shall be Type I, unless otherwise specifically approved by the Architect or the Structural Engineer.

Concrete Testing:

All concrete material testing shall be performed by an independent testing laboratory selected and engaged by the Owner.

Architectural Concrete:

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

Finishes:

Concrete floors shall not vary more than 1/8" in ten (10) feet when measured in any direction.

Concrete floors shall slope uniformly to floor drains to provide adequate drainage without puddling. Level floors with "dished" areas around drains are unacceptable.

Concrete floors not receiving an applied finish flooring material shall be cured and protected in a manner that will give a finished surface uniform in color and texture.

Concrete floors scheduled to receive applied finishes shall not have an application of concrete curing compound or sealer.

Provide all exterior concrete ramps, walks, loading docks, aprons and similar applications subject to weather with a non-slip broom finish.

Sustainability

Generally, the use of cement substitutes and additives in the concrete design that promote the use of recycled materials such as fly ash and slag shall be considered. All projects shall attempt to use concrete materials and products that are extracted, recovered, and / or manufactured in Georgia. If out of state, within less than 250 miles.

END OF SECTION

DIVISION 04 00 00 – MASONRY



General:

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

Selections shall consider the context surroundings of the project and its palette of materials / details. Brick for additions to existing buildings shall match, as closely as feasible, the existing brick. New brick walls should not be in the same plane as existing adjacent walls; i.e., side-by-side. New walls should be angled into existing walls, preferably at 90°.

Materials / Products:

For reference, the following brick selections have been utilized in projects at GSU locations. They are offered as a basis for design:

Downtown Campus:	Not applicable.
Alpharetta Campus:	Not applicable.
Dunwoody Campus:	Boral Bricks, Inc.; 3-534 Coventry Antique Carolina Ceramics; Heritage D/S Smooth
Clarkston Campus:	Boral Bricks, Inc.; 10-828 Hanson Brick: Carolina Collection - Dark Palomino Wire Cut
Decatur Campus:	Richtex; 502-3A Cloud Ceramics; French Grey – Velour Texture Statesville Brick Company – Jackson Custom
Newton Campus:	General Shale – Cambridge Cherokee - Providence

Concrete Masonry Units: Bull-nosed block shall be used on all outside corners in the interior of buildings. Expansion joints shall be provided and reviewed with the GSU Project Manager.

Cavity Wall Construction: A continuous mat system for air space maintenance and drainage in the cavity wall such as CavClear Masonry Mat or similar shall be utilized. Through wall metal flashing: Provide at the base of the wall, above and below all wall openings, at the tops of walls, beneath copings, and any other discontinuities in the air space, such as recessed courses or shelf angles.

All weep holes should be protected from insect entry and shall be a minimum of 8" above finished grade

Sustainability:

All projects shall attempt to use masonry materials and products that are extracted, recovered, and / or manufactured in Georgia. If out of state, within less than 250 miles of the site. Where reasonable, projects shall attempt to reuse existing bricks, stone, pavers and similar masonry materials.

END OF SECTION



DIVISION 05 00 00 – METALS

General:

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 compatible materials or compatible fasteners.

All exposed structural steel in exterior locations must be hot dipped galvanized or stainless steel.

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 sprayed-on fireproofing systems.

Miscellaneous Metals:

Handrails and guardrails shall be stainless steel with brushed satin finish. Painted steel railings should be avoided unless located in the interior and integral to the design intent or required by project budget.

Exterior ladders, stairs, landings and platforms shall be hot dipped galvanized. Ladders shall utilize prefabricated (not round) non-slip rungs.

Pipe bollards shall be hot dipped galvanized and covered with a plastic bollard sleeve.

Testing:

All testing, inspections and evaluations of connections shall be performed by an independent testing laboratory selected and engaged by the Owner.

END OF SECTION



DIVISION 06 00 00 – WOOD, PLASTICS, AND COMPOSITES

Rough Carpentry:

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

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

Generally, wood material shall not be used for any structural elements.

Treated wood shall be used at the following locations:

Grounds, nailers, and other wood to be left in place in contact with concrete or masonry.

Wood members used for rough framing of openings in exterior walls.

Plywood used for parapet construction and exterior applications.

Architectural Millwork and Cabinetry:

All architectural millwork and cabinetry shall meet AWI standards.

Countertops: Generally, use solid surface materials for restroom, break area countertops and backsplashes. Where the Project Budget requires, with the exception of restrooms, plastic laminate on medium density fiberboard is acceptable.

Generally, use solid surface materials for window sills. Where the Project Budget requires, plastic laminate on solid wood or exterior grade plywood is acceptable.

Generally, exterior wood trim, when used, shall be kerfed and back-primed before installation.

END OF SECTION



DIVISION 07 00 00 – THERMAL AND MOISTURE PROTECTION

General:

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.

Moisture Control:

Prevent moisture problems (underground). Provide sheet membrane waterproofing and positive slope foundation perimeter drains to grade. Use protection board over all membranes. Vertical drainage sheets shall be specified for waterproofed walls. The filter fabric shall wrap a perforated foundation drainage pipe at the base of the wall footing. The drainage pipe shall discharge into the nearest storm water collection system, if available.

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 $\frac{1}{4}$ inch per foot minimum.

Dampproofing shall be required on all concrete block surfaces in cavity wall type construction.

Vapor Barriers - Polyethylene is not an acceptable vapor barrier for use under concrete slabs on grade.

Roofing:

Low Pitched Roofs:

For concrete roof deck applications: provide a peel and stick or torched down temporary roof.

For most applications: 80 mil Gray PVC roofing membrane or a modified bitumen roofing membrane. Consult with the GSU Project Manager for selection. Use polyisocyanurate roof insulation and tapered insulation. Provide with a 20-year warranty.

For select applications: Hybrid Roofing System consisting of a reinforced single ply 60 mil Gray PVC fleece backed roofing membrane over a modified bitumen roofing membrane over fiberglass-mat faced gypsum roof cover boards over polyisocyanurate roof insulation and tapered insulation. Provide with a 20-year warranty.

Architectural/High Pitched Roofs:

Standing seam metal panels with underlayment. Provide preformed 24 gauge hot-dipped zinc coated fluorocarbon polymer coated steel sheet standing seam metal roofing. Provide with a 20-year warranty. Panel colors campus specific as follows:

Downtown Campus:	As approved by the GSU Project Manager
Alpharetta Campus:	As approved by the GSU Project Manager
Dunwoody Campus:	Teal Green
Clarkston Campus:	Hemlock Green
Decatur Campus:	Hemlock Green



Newton Campus: Metallic Silver

Metal flashing shall be 16 oz. copper, .040" anodized aluminum or stainless steel. Galvanized steel flashing shall not be used, unless deemed necessary when adding on to an existing system.

Roofing material specifications shall require the use of "non-asbestos-containing material".

Roofing must be installed by a manufacturer approved installer.

Specify manufactured equipment curbs or raised (24" min.) equipment stands for all roof-mounted equipment. Equipment shall not be mounted on pressure treated wood, plastic pads or panels set directly on roof surface.

Insulation:

Minimal insulation requirements shall comply with the latest ASHRAE requirements and in no case shall be less than:

Roof Decks: R25
Walls: R19
Attic Ceiling: R38
Exposed Floors: R30

END OF SECTION



DIVISION 08 00 00 - OPENINGS

General:

Doors:

Doors shall be standard 3'-0" x 7'-0" x 1-3/4" wherever possible.

Hollow metal doors shall be 16 Gauge galvanized steel construction.

Wood doors shall be 5 ply solid core plain sliced select white birch, book-matched. Core construction shall be particle core unless mineral core is required for fire resistance rating. Tops and bottoms of wood doors must be finished. Exception: match existing adjacent door veneers in renovation projects. Wood doors shall be factory finished. Wood doors shall receive stained transparent finish. Wood doors shall not be painted unless approved by the GSU Project Manager.

Door frames shall be hollow metal, 14 gauge for exterior doors and 16 gauge for interior doors. Generally, frame miters shall be welded and ground smooth. Knock-down frames shall only be used where welded frames are not practical.

If possible, where doors swing out, use a full height metal astragal for security.

Provide keyed removable mullions at pairs of doors.

All locksets shall be Grade 1. All locksets shall accommodate Best 7 pin interchangeable cores. Keyway shall be selected by the University Key Control Office. Best shall provide cores directly to the University Key Control Office. The University will provide a keying schedule to Best for large projects. 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.

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.

Provide revolving doors, and / or automatic doors with airlocks at all main entrances.

Automatic Sliding Doors: Provide Horton Automatics Series 2003 Electric Belt Drive Operator with Aluminum Door Panels or an approved equal.

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:

- Type 010: Sliding panel(s) shall slide along interior side.
- Type 110: Slide-Swing panel(s) shall slide along exterior side.
- Type 310: Slide-Swing panel(s) shall slide along interior side. Breakaway sidelite.



- Type 410: Slide-swing panel shall slide between fixed sidelite/wall and breakaway sidelite.
- 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.

Automatic Swing Doors – Provide Horton Automatics Series 4000 heavy duty electric swing door operators or an approved equal. Power door operators shall have a two year warranty. Actuators shall have a stainless steel touch plate with a blue filled handicap symbol. The actuator shall be weather resistant and provide normally open momentary contacts.

Manufactured Door Units:

- 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.
- 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.
- 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.

Aluminum Entrances, Storefronts and Curtainwall:

Stacked storefront in lieu of curtainwall is NOT acceptable.

Framing System: high performance thermal storefront systems with a u-value of 0.61 or less.

Door Construction:

- Rails: 2" deep, 3/16" thick, 5" wide minimum top rail, 6 ½" wide minimum bottom rail
- Stiles: 2" deep, 3/16" thick, 5" wide minimum



- Must accept glazing in-fills from ¼" to 1"
- Doors shall not exceed 8'-0" in height

Aluminum finishes must be as follows unless approved otherwise by the GSU Project Manager:

- Downtown Campus: As approved by the GSU Project Manager
- Alpharetta Campus: Kynar 500 Valspar White Blush Color 391 13235
- Dunwoody Campus: Dark Bronze Anodized
- Clarkston Campus: Clear Anodized
- Decatur Campus: Dark Bronze Anodized
- Newton Campus: Clear Anodized

Door Hardware:

Hinges: Fully mortised ball bearing hinges for all applications. Non-removable pins must be used on all exterior applications. Provide continuous gear hinges at all exterior doors and heavily used interior doors. Continuous gear hinges shall be manufactured of extruded 6063-T6 aluminum alloy with anodized finish, or factory painted finish.

Butt Hinges: Acceptable manufacturers:

Hager Hinge Company
Stanley Works
McKinney

Continuous Hinges: Acceptable manufacturers:

Markar
Select Products
Zero

Locksets: Fully mortised locksets with lever handles.

Acceptable Manufacturers and Series:

Best 40H Series x 14H
Schlage L9000 Series x 17B

Key Cores: The Institution will only accept removable interchangeable key cores (SFIC) keyed into the existing keying systems as follows:

All Campuses: Best

Closers: Closers with heavy duty cast iron cylinders with all-weather hydraulic fluid and thru-bolted. Closers shall be provided with a ten year warranty. Concealed closers and floor closers are not acceptable. Closers must be thru-bolted on hollow metal and wood doors.

Acceptable Manufacturer and Series:

LCN Closers, 4000 Series



Exit Devices: All exit devices mounted on labeled wood doors shall be thru-bolted mounted on the door per the door manufacturers' requirements. All trim shall be thru-bolted to the lock stile case. The institution prefers rim devices with a keyed removable mullion. Cylinder dogging is preferred. Exit devices shall be provided with a three year warranty.

Acceptable Manufacturer and Series:
Von Duprin, CD98/98 Series

Trim plates: The Institution prefers .050" thick stainless steel. Provide both mop plates and kick plates for doors to toilet rooms, custodial closets, kitchens, concessions and locker rooms.

Thresholds: The Institution prefers extruded aluminum, complying with ADA requirements.

Hardware finishes: The Institution prefers US32D or US26D for most applications.

Glass and Glazing:

Installed glazing systems shall withstand normal thermal movement and wind and impact loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, or other defects of construction.

Generally, exterior glass shall be comprised of insulated glass units with a 1" nominal thickness utilizing ¼" thick clear inboard pane, ½" air space, and ¼" thick outboard pane. Tinting of the outboard pane shall be as follows:

- Downtown Campus: As approved by the GSU Project Manager
- Alpharetta Campus: AGC Stopsol Classic Green
- Dunwoody Campus: Bronze tinted
- Clarkston Campus: Gray tinted
- Decatur Campus: Bronze tinted
- Newton Campus: AFG Sunergy Green

END OF SECTION



DIVISION 09 00 00 - FINISHES

Gypsum Board:

Drywall Construction

Generally, provide 5/8" gypsum board on metal studs at 16" o.c. Insulate partitions surrounding restrooms, classrooms, conference rooms and other sound sensitive spaces with sound attenuation batts and apply acoustical caulking at joints with other surfaces.

Do not terminate partitions at ceiling grid without prior approval. If approved, trim top edge of gypsum board partition with ceiling system trim. Trim shall have painted white finish.

Generally, new walls shall be finished to Level 4. New walls scheduled to receive special wall treatment shall be finished to Level 5.

High abuse gypsum board shall be considered for public corridors.

Moisture resistant gypsum board shall be used at wet walls.

Cement backer board shall be used as a substrate for ceramic tile.

Acoustical Tile Ceilings:

Generally, provide exposed 15/16" grid with 2' x 2' lay-in type acoustical tiles.

The Acoustical Tile Standard for each campus is as follows:

Downtown	Armstrong 705	tegular edged 15/16" grid
Clarkston	Armstrong 756	square edged 15/16" grid
Decatur	Armstrong 756	square edged 15/16" grid
Dunwoody	Armstrong 756	square edged 15/16" grid
Alpharetta	Armstrong 756	square edged 15/16" grid
Newton	Armstrong 1776	tegular edged 15/16" grid

For lobbies, major conference rooms and major public areas, provide Armstrong Cirrus Tegular, # 534, white.

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

For renovation projects, match existing tile if available.

Inaccessible ceiling systems should be avoided.

Flooring and Wall Treatment:

Custodial Closets shall be VCT or sealed concrete.

Electrical room floors shall be sealed concrete.



Mechanical room floors: For slabs on grade, provide Sherwin Williams Armorseal 8100 SW0256 Serious Gray in satin finish. For elevated slabs, provide Sika Sikafloor Merflex Waterproofing Broadcast System in Window Gray.

Laboratories shall be finished with flooring and wall treatment specific to the lab.

Ceramic tile is the preferred finish for floors and walls in toilet rooms. Ceramic tile from floor to ceiling is preferred. Light colored grout is unacceptable for flooring. Generally, grout color shall be darker than tile color.

Ceramic Tile:

The design, specifications, materials and installation shall adhere to all applicable ANSI and ASTM codes and standards, in addition to the Handbook for Ceramic Tile Installation, Tile Council of America (TCA).

Carpet Tile:

Carpet Tile shall comply with the following:

- 100% solution dyed
- Solid backing with synthetic fabric scrim
- Gage 5/64ths or better and 10 stitches per inch
- Pile height average 0.187"
- Nylon fiber type 6 or 6-6
- 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
- Warranty: 15 years minimum
- Direct glue down method

Resilient Flooring:

Vinyl Composition Tile (VCT) shall be 12" x 12", 1/8" gauge or equal. Use waterproof glue for vinyl tile applied to below grade floor slabs. Finish floors with 2 applications of wax – Eco Lab Mono Star by Southeastern Paper Group.

Luxury Vinyl Tile (LVT) shall have a minimum total thickness of 0.120" (3.05mm) (Standard ASTM F386). The wear layer shall have a minimum thickness of 30 mil (.076mm) (Standard ASTM F410).

Resilient Base and Accessories:

Rubber wall base shall be continuous coil lengths rolls and shall be four-inch (4") cove base. Straight wall base is unacceptable. Inside and outside corners shall be job formed. Avoid light colored base.

Transition strips shall be two-piece rubber type.

Exterior Painting:

All exterior paint colors must be reviewed and approved by the GSU Project Manager.

Interior Painting:

All paint color selections must be reviewed and approved by the GSU Project Manager.



Generally, wall paint shall be eggshell finish.

Wall paint for laboratories shall be gloss finish.

Generally, paint for door frames shall be semi-gloss and match the wall color.

Paint for dry wall ceilings shall be flat finish.

END OF SECTION



DIVISION 10 00 00 - SPECIALTIES

Signage:

Interior Signage shall conform to the design and specifications in Appendix A – Interior Signage.

Exterior Signage shall conform to the design and specifications in Appendix B – Exterior Signage.

Toilet Compartments:

Toilet compartments shall be stainless steel or pebble grained HDPE (as manufactured by ASI Global Partitions or approved equal) unless approved otherwise by the GSU Project Manager. Floor mounted, overhead braced systems shall be specified for toilet partitions and urinal screens. Only stainless steel hardware shall be utilized. Continuous hinges shall be used for all partition doors. There shall be no sight line through or around the door.

Toilet Accessories:

Soap dispensers shall be provided by the University and installed by the contractor. The University is currently providing Gojo ADX-12 soap dispensers.

Paper towel dispensers shall be provided by the University and installed by the contractor. Locations near sinks are desired in addition to near entry doors. The University is currently providing Pro-Link Elite Hands-Free 8" Black Towel Dispensers.

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. The contractor shall provide and install the toilet tissue dispensers.

Seat covers shall be surface mounted stainless steel. The basis of design shall be Bobrick B-221 Classic Series. The contractor shall provide and install the seat covers.

Sanitary Napkin disposal receptacles should be surface mounted type in each toilet stall, not thru partition type serving two stalls. The basis of design is Bobrick B-270 Contura Series Surface-Mounted Sanitary Napkin Disposal in stainless steel finish. The contractor shall provide and install the sanitary napkin disposal receptacles.

Mirrors: Individual mirrors at each lavatory are preferred in most applications, especially in restrooms subject to heavy student use. The contractor shall provide and install the mirrors.

Stainless Steel Shelves are desirable above urinals and in toilet stalls when space allows. The contractor shall provide and install the stainless steel shelves.

Trash Receptacles shall be freestanding units. Receptacles shall not have lids. The contractor shall provide and install trash receptacles as follows:

- For large toilet rooms: The basis of design shall be Rubbermaid Untouchable 35 gallon square gray receptacles.



- For small single stall toilet rooms: The basis of design shall be Rubbermaid Untouchable 23 gallon square black receptacles.

Diaper Changing Stations: The contractor shall provide and install wall mounted flip down units in all restrooms available for general public use. The basis of design shall be Koala Kare KB200-SS.

Corner Guards:

Corner guards are required on walls at high traffic areas. Corner guards shall be 48" high heavy duty type stainless steel.

Visual Display Boards:

Provide glass marker boards, non-magnetic. A marker board tray should be fixed to the wall directly below the marker board and run the full length of the marker board. The marker board shall be 4'0" tall x the appropriate width. Note: verify the path of delivery when specifying boards wider than 70". Do not provide map/display rails.

Fire Extinguisher Cabinets:

Provide nominal 2'-0" high by 10" wide by 6" deep 20 GA cold-rolled steel or .040 inch thick formed aluminum cabinets. Provide solid panel door design. Finish shall be manufacturer's standard white baked enamel. Provide die-cut vinyl self-adhering lettering reading "FIRE EXTINGUISHER" in 1" high red letters.

END OF SECTION



DIVISION 11 00 00 - EQUIPMENT

Audio Visual Equipment Standards:

See Appendix D.

Laboratory Fume Hoods

Comply with the current edition of the Board of Regents' Design Criteria for Laboratories.

Manufacturers

Acceptable Manufacturers shall include:

Air Master Systems Corporation
Jamestown Metal Products, Inc.
Kewaunee Scientific Corporation
Labconco Corporation
Mott Manufacturing Limited

Furnish and install casework, furnishings and fume hoods by the same supplier.

Fume Hood Materials

Sheet Steel: Metallic furniture stock: ASTM A-1008 mild steel, cold rolled, pickled, double annealed and free from defects. 18 Gauge thick exterior casing, ceiling closure panels and bottom sash rail. Finish shall be electrostatically applied epoxy or urethane powder coat painting that coats all hidden and exposed surfaces with an acid and abrasion resistant coating. Bake in a controlled high temperature oven to ensure a smooth, hard satin finish. All interior and exterior surfaces exposed to view, backs of cabinets and fume hoods not exposed to view, and drawer bodies shall be finished in this manner. Color selection from manufacturer's standard selection.

Stainless Steel: Type 304 or Type 316 as indicated: ASTM A240; 16 gauge – exposed surfaces ground and polished to a Number 4 finish. All stainless steel welding material shall be a type similar to the sheet metal. Welds shall be made without discoloration and ground, polished and passivated to blend with the Number 4 finish.

Epoxy Resin Sheets: Epoxy Resin Tops shall consist of modified epoxy resin that has been especially compounded and cured to provide the optimum physical and chemical resistance properties required of a heavy-duty laboratory working surface. Uniform mixture throughout, not dependent on a surface coating.

Glass: 7/32 inch clear laminated safety glass.

Benchtop Chemical Fume Hoods

Factory UL 1805 Classified.

Superstructure:

Wall: Rigid, self-supporting assembly of double wall construction, nominal 5 inches thick.
Double wall shall consist of a sheet steel outer shell and a corrosion resistant inner lining and



shall house and conceal steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Hoods shall be completely factory assembled to form a rigid, self-supporting structure.

Interior Hood Height: 48 inches minimum to hood roof.

Exterior Bypass: Low resistant down draft type. Bypass air shall enter at full length opening at the top front superstructure to enter hood in a down flow direction. Directional louvers are not acceptable.

Interior Bypass: Coordinate with the mechanical system and overall project requirements.

Fastenings: Interior and exterior fastening devices shall be concealed. Exposed screws are not acceptable.

Sill:

Bypass type designed to prevent reverse air flows or air eddies at the fume hood work surface. Sill to include an integral spill trough with hinged louvered horizontal panels that allows pass thru of hospital grade electrical plugs. Mount sill assembly flush with bottom of fume hood work surface. Provide a chemical resistant sealant between sill and work surface.

All components shall be 16 gauge Type 304 stainless steel, with an acid and abrasion resistant electrostatic epoxy or urethane powder coating.

Sash:

Full view type with clear, unobstructed, side to side view of fume hood interior and service fixture connections.

Sash: Coordinate the method of opening the sash with project requirements based upon the specific needs of the end user.

Provide sash stops at the design sash opening. Counter balanced chain and sprocket system. Sash shall move smoothly without tilting or binding. Coordinate the balancing of the sash to either remain open in any position or to automatically return to 18" based upon the needs of the end user.

Sash Glass: 7/32 inch thick laminated safety glass.

Sash Guides: Corrosion resistant polyvinyl chloride.

Liners: Polyester Liner: Reinforced glass polyester panel, smooth finish and white in final appearance. Provide gasketed access panels in the liner for service access to valves and fixtures.

Baffles: Provide fixed baffles to control air vectors into and through the fume hood. Fabricate of the same material as the liner. All baffle supports and brackets shall be non-metallic.



Work Surfaces: Provide molded epoxy resin.

Sinks: Provide epoxy resin sinks.

Service Fixtures and Piping: Provide Factory pre-piped hoods. Provide the product of one manufacturer for all service fixtures unless otherwise required. Provide all fixtures designed for laboratory use. Provide all fixtures, valves, and accessories made of cast or forged brass unless the fixture is for DI service. All service fixtures shall be assembled at the factory and fume hoods shall be furnished with all nipples, threaded collars, locknuts, shanks, and other accessories required to properly mount and connect the fixtures. All fixtures shall be tested at the factory. Valves and fixtures, except water fixtures, shall withstand a test pressure of 100 pounds per square inch. Test all water fixtures at 80 pounds per square inch. Provide vacuum breakers for all water lines. Fixture finish shall be chrome over all visible areas. Provide laboratory service fixtures inside of the fume hood with an acid and solvent resisting clear plastic coating applied over a finely sandblasted and properly cleaned surface. Surface to be coated shall be sprayed and baked three times for minimum thickness of 6 mils. The plastic coating colors shall correspond to the indexed disc colors. The colors for services shall be industry standard. On fume hoods with pre-punched service fixture holes, provide metal or plastic plugs in color to match the fume hood, for all unused holes.

Electrical: Factory install all lighting, switches, and receptacles in the fume hood. Terminate wiring to a single service junction box on the top of the fume hood for in-field point of connection. All electrical fixtures shall be UL listed and labeled. All electrical fixtures shall conform to applicable state and local codes. Provide GFCI receptacles on front of hoods in color to be selected by Architect. Provide associated cover plates in finish to be selected by Architect. Provide a dedicated receptacle at the top of each hood for the safety monitor alarm. Provide a two lamp UL listed fluorescent light fixture on the exterior of the fume hood roof. The light shall be serviceable from inside of the fume hood. Include the lamps with the fixtures. Light fixtures shall provide 80 foot-candle minimum average at the work surface. Provide a light switch at the front of the fume hood.

Exhaust Outlet: 18 gauge thick, Type 316 stainless steel.

Equip each fume hood with a velocity control and safety alarm unit. Calibrate each alarm in the field after testing and balancing is complete.

Fume Hood Testing and Certification: After the installation of any new fume hood and after testing and balancing is complete, provide fume hood testing and certification in accordance with ASHRAE Standard 110. Certify each hood operation and affix a label to the face of the fume hood indicating test results, the name of the evaluator, and the date of the test. Provide a copy of the certification and test results to the Architect.



Automated External Defibrillators (AEDs):

Provide a minimum of one AED for each new building. Provide Philips model as follows:

Part No.	Description
M5066A	Philips OnSite AED (includes 8 year warranty, 4 year battery, Adult AED pads, AED inspection tag and "AED On-Site" window sticker)
OPT C02	Philips OnSite Slim Carrying Case
AB 3102	AED/CPR Premium Response Kit
PFE7023D	Philips Brand Premium Semi-Recessed Cabinet

END OF SECTION



DIVISION 12 00 00 – FURNISHINGS

Furniture:

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

Consultant shall provide specific furniture in accordance to the program for each project and selections shall be from the Georgia State Wide Contract.

Any furniture that is hardwired must be bolted/anchored to the floor.

General Classrooms:

- Consultant shall provide seating with adequate circulation space.
- Audio-visual requirements and instructor stations shall be coordinated with GSU's IIT department. Refer to Appendix D – AV Standards.
- Fixed Seating – Fixed seating shall be 20" wide minimum. Proper spacing should be allowed for a variety of body types and persons with disabilities.
- Tablet armchairs shall have oversized tablets.

Fabrics:

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 60,00 double rubs shall be accepted in any University space. Krypton-protected and other water and stain resistant fabrics are recommended.

Consultant shall take care not to specify light-colored upholsteries nor tone-on-tone and/or solid upholsteries.

Art:

All public art must be approved in writing by the GSU Project Manager, prior to purchase and installation.

WINDOW TREATMENTS:

Window Blinds:

Generally, all windows shall receive window treatment. Acceptable treatment shall consist of 1" horizontal mini blinds. Blinds shall be .008" minimum painted aluminum. Vertical blinds are not acceptable. Individual window treatment width shall match vertical window mullion spacing.



Curtains and Drapes:

Fabric curtains and drapes are unacceptable for window treatment unless approved in writing by the GSU Project Manager.

Window Shades:

Motorized shades in student spaces shall have protective plastic covers installed over controls to prevent tampering.

Entrance Mats:

Entrance mats shall be provided for all buildings. The soil entrapment area shall be no less than 6 feet in width by the width of the entrance door; rubber, non-slip backing, and non-curl edging. Recessed mats must be approved by the GSU Project Manager.

Laboratory Casework and Related Products:

Comply with the current edition of the Board of Regents' Design Criteria for Laboratories.

Manufacturers

Acceptable Manufacturers shall include:

FOR WOOD CASEWORK:

Campbell Rhea International
Caseworx Inc.
CiF Lab Casework Solutions
Kewaunee Scientific Corporation
Mott Manufacturing Limited
Sheldon Laboratory Systems
Diversified Casework

FOR METAL CASEWORK:

Lab Crafters
Air Master Systems
ICI Scientific
Hamilton Laboratory Solutions
Kewaunee Scientific Corporation
Mott Manufacturing Limited

FOR WORK SURFACES:

Durcon
Epoxyn
Trespa
Kewaunee

FOR LABORATORY FIXTURES:

Water Saver
Chicago Faucets

Furnish and install casework, furnishings and fume hoods by the same supplier.



Wood Casework

All exterior casework surfaces exposed to view after installation, and the exposed interior ends, top and bottom of open cases or cases having glazed doors, shall be Red Oak unless otherwise approved by the GSU Project Manager.

Construct wood casework in accordance with Premium Grade of the Architectural Woodwork Standards, latest edition.

Casework style shall be flush overlay unless otherwise approved by the GSU Project Manager.

All solid woods shall be carefully and thoroughly air-dried, then kiln dried in humidity controlled kilns to a moisture content of 4-1/2%. All kiln dried lumber shall then be tempered to a moisture content of 6% before use. This moisture content shall be maintained throughout production. Solid woods exposed to view after completion of installation shall be clear, with color and graining in conformance with the normally accepted standards required of the Scientific Laboratory Equipment Industry.

Plywood face veneers used for exterior surfaces exposed to view after installation, and the exposed interior ends, top and bottom of open cases, or cases having glazed doors, shall be A-1, plain sliced, book matched, Red Oak, veneer core. Grain direction shall be vertical matched on all cabinet drawer heads, doors, end panels, aprons, and fillers. Horizontal grain will be permitted only on cabinet tops, bottoms, and fixed or adjustable pullout shelves. Softwoods such as Fir or Pine are not permitted.

All interior plywood used in cabinets, unexposed to view, shall be 7-ply, B-2, hardwood, veneer core. Softwoods such as Fir or Pine are not permitted.

Lumber core plywood and plywood used for doors and drawer heads shall be 5-ply, Grade A, plain sliced, book matched, Red Oak, face; banded hardwood lumber core; Grade B, plain sliced, book matched, Red Oak, back. Softwoods such as Fir or Pine are not permitted.

Tempered hardboard shall be a wood fiber/resinous combination formed with heat and pressure into sheets providing a hard, smooth surface.

Plywood shall be compatible in color and well matched in color and grain with adjacent plywood panels. Darker and lighter panels in the same run of bench or same room after installation of casework is not acceptable.

Where possible, provide extended end panels in lieu of filler panels.

Provide security panels between doors and all drawers on all base cabinets with locks.

Provide removable backs on all cupboard units and base cabinets that have utilities behind them.

Glass used for framed sliding and swinging doors shall be 1/8" float glass. Glass used for



unframed sliding doors, shall be 1/4" float glass.

Dowels used to join frames and panels shall be fluted hardwood not less than 3/8" In diameter.

Metal Casework

Metal casework shall be of modern design and shall be constructed in accordance with the best practices of the Scientific Laboratory Equipment Industry. Each cabinet shall be complete so that units can be relocated at any subsequent time without requiring field application of finished ends or other such parts. All cabinets shall have a cleanable smooth interior.

Cabinet style should be full overlay unless otherwise required by the Owner's Project Manager.

Base cabinets shall have intermediate rails between doors and drawers, but shall not be provided between drawers unless made necessary by locks on drawers. Cupboard units and units with utilities behind them shall be provided with removable back panels.

Drawer suspension assembly shall consist of two sections providing a quiet, smooth operation on ball bearing nylon rollers. All drawers shall be self-closing from a point 5" open and be removable without the use of special tools.

Knee space panels shall be finished the same as cabinets and shall be easily removable for access to utilities.

Upper cabinets and full height cabinets shall have a completely finished interior same as exterior.

Specialty Cabinets Below Fume Hoods

STEEL CORROSIVE STORAGE CABINETS:

Corrosive storage cabinets shall utilize the same gauge of steel and construction features as other metal cabinets in the lab. Corrosive cabinets shall also be completely lined with a one-piece polyethylene liner meeting SEFA standards. The liner shall be ¼ inch thick, molded into a seamless tub including top, sides, and bottom, with a 1 inch lip at the bottom front to contain spills. The liner shall have a large gasketed polyethylene access panel to provide access to utilities behind or it must be completely removable.

Each door shall have a set of louvers and a 1/8 inch polyethylene liner. Provide a solid phenolic shelf in each cabinet. Label all cabinets "CORROSIVES"

Each cabinet shall be vented directly into the fume hood with a flexible pipe so that fumes are directed into the fume hood exhaust system with positive airflow.

STEEL SOLVENT STORAGE CABINETS:

Solvent storage cabinets shall be specifically designed for the storage of flammable and combustible liquids and shall be UL listed. Doors shall swing on full-length stainless steel piano hinges and shall be fully insulated. Doors shall also be self-closing and synchronized so that both doors will always fully close. The right doors shall be equipped with a three-point latching system that automatically engages when the doors close.



Each door shall be equipped with a fusible link hold-open feature that will ensure that the door closes when temperatures exceed 165 degrees Fahrenheit.

Provide a 2 inch deep liquid-tight pan at the bottom of the cabinet, a full-depth adjustable shelf, a grounding screw on the back of the cabinet, and label the cabinet "FLAMMABLE – KEEP FIRE AWAY."

Do not vent solvent cabinets into the fume hood or HVAC system unless required by the Owner's Project Manager.

WOOD CORROSIVE STORAGE CABINETS:

Corrosive storage cabinets shall be constructed the same as other wood casework in the laboratory, including hardware, locks, and finish.

Corrosive cabinets shall also be completely lined with a one-piece polyethylene liner meeting SEFA standards. The liner shall be ¼ inch thick, molded into a seamless tub including top, sides, and bottom, with a 1 inch lip at the bottom front to contain spills. The liner shall have a large gasketed polyethylene access panel to provide access to utilities behind or it must be completely removable.

Each door shall have a set of louvers and a 1/8 inch polyethylene liner. Provide a solid phenolic shelf in each cabinet. Label all cabinets "CORROSIVES"

Each cabinet below a fume hood shall be vented directly into the fume hood with a flexible pipe so that fumes are directed into the fume hood exhaust system with positive airflow. Tall corrosive storage cabinets and undercounter corrosive cabinets not under a fume hood shall be vented directly into the building HVAC system.

WOOD SOLVENT STORAGE CABINETS:

Solvent storage cabinets shall have the same finish as other wood casework in the laboratory but shall have different hardware as specified below.

Solvent storage cabinets shall be specifically designed for the storage of flammable and combustible liquids and shall be UL listed. Doors shall swing on full-length stainless steel piano hinges and shall be fully insulated. Doors shall also be self-closing and synchronized so that both doors will always fully close. The right doors shall be equipped with a three-point latching system that automatically engages when the doors close.

Each door shall be equipped with a fusible link hold-open feature that will ensure that the door closes when temperatures exceed 165 degrees Fahrenheit.

Provide a 2 inch deep liquid-tight pan at the bottom of the cabinet, a full-depth adjustable shelf, a grounding screw on the back of the cabinet, and label the cabinet "FLAMMABLE – KEEP FIRE AWAY."

Do not vent solvent cabinets into the fume hood or HVAC system unless required by the Owner's Project Manager.



Flexible Laboratory Furniture Systems

The system shall consist of a fully welded vertical framework with slotted uprights to support work surface table frames and shelving components; and matching stand-alone table frames. Slots shall extend 30" from top of uprights, typical.

System shall be self-supporting and independent of the building structure. The vertical framework shall be designed to accommodate pre-wired electrical and data outlets, as well as pre-piped plumbing utilities.

The vertical height of all worksurfaces shall be adjustable from 30 inches to 36 inches in 1 inch increments.

The metal finish shall be the same as other metal casework in the laboratory.

The system components shall include: modular support structure, structural table base, worksurfaces, shelves, power/data/plumbing connections, mobile base cabinets, ceiling service panels, matching stand-alone table frames, quick connects and associated piping, power receptacles and associated plugs and wiring, and data jacks and associated plugs and wiring.

Cabinet style shall be full overlay unless otherwise required by the Owner's Project Manager.

Plumbing fixtures shall be piped at the factory to a quick connected located either at the top of the frame or at the ceiling service panel. The length of the hoses shall be coordinated with the ceiling height at each frame so the hoses reach the ceiling but are not overly long.

Power and data devices shall be installed and wired at the factory and all benches shall be UL labeled. Power to the electrical devices shall terminate at a twist lock plug located at the ceiling service panel. The data devices shall also be terminated at the ceiling service panel. The length of the cords shall be coordinated with the ceiling height at each frame so the hoses reach the ceiling but are not overly long.

Ceiling service panels shall be compatible with most T-grid acoustical suspended ceiling structures and shall be furnished with all quick connects, plumbing connections, power receptacles and back boxes, and data receptacles and back boxes required for the benches.

Bundle together all cords and hoses with spiral wrap.

Hardware

Drawer and door pulls shall be anodized aluminum of modern design, offering a comfortable hand grip, and be securely fastened to doors and drawers. Use of plastic pulls (molded or extruded), or a design not compatible for usage by the handicapped will not be acceptable.

Flush pulls for sliding doors shall be satin finish chrome, providing a recessed finger grip. Finger holes or slots machined into doors will not be acceptable.

Hinges shall be five (5) knuckle, satin finish stainless steel, institutional, offset type for all swinging doors. Hinges shall be 2-1/2" long, and secured to cabinet and doors with flathead



screws, so applied to withstand a weight load of 150 lbs. minimum.

Locks when shown or called for shall be 5-disc tumbler with heavy duty interchangeable cylinder. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers. Locks shall have capacity for 225 primary key changes. Master key one level with the potential of 40 different, non-interchangeable master key groups.

Keys shall be stamped brass available from manufacturer or local lock smith. At a minimum, provide 2 keys for each keyed different lock; 3 keys for each group keyed alike; and 2 master keys for each system.

Roller Catches shall have a spring-loaded polyethylene roller and a steel strike plate. Provide an elbow catch for the left hand door of tall cabinets at the fixed center shelf. Pull chains are not permitted.

Drawer slides shall be rated at 100 pounds minimum and shall be full extension type. They shall consist of two steel epoxy coated sections providing a quiet, smooth operation on nylon rollers. Case channels shall maintain alignment of drawer. Slides shall wrap under drawer sides for additional support. The drawer shall be removable without the use of tools.

Leg shoes shall be provided on all table legs, unless otherwise specified, to conceal leveling device. Shoes shall be 2-1/2" high and a pliable, black vinyl material. Use of a leg shoe which does not conceal leveling device will not be acceptable.

Floor glides, where specified for movable open-leg tables, shall be a non-marring material at least 1" dia. to prevent indenting composition flooring and shall have at least a 5/8" height adjustment. Use of metal buttons will not be acceptable.

Shelf support clips shall be twin pin type for mounting on interior of cabinet end panels. Clips shall be corrosion resistant and shall retain shelves from accidental removal. Shelves shall be adjustable on 32mm centers. Surface mounted metal support strips and clips subject to corrosion are not acceptable.

Upright rods, cross rods and ring support rods, where specified, shall be anodized Duraluminum (1/2" or 3/4" dia., as required). Rod sockets shall be chrome plated brass, secured through table tops with lock nut and spring washer. Rod clamps shall be heavy duty, designed to securely hold rod assembly in any position. Use of wood rod assemblies will not be accepted.

Label holders, where shown or called for, shall be formed steel with satin chrome finish, 3-1/2 inch wide by 1-1/2 inch high, to accept a card sized 2-3/4 inch wide by 1-1/4 inch high, screw installed.

Number plates, where shown or called for, shall be type 304 stainless steel, 16 gauge with a number 4 finish. Attach plate to drawer with flathead steel screws countersunk at each corner. Engrave each plate with 1/2 inch high numbering. Numbering selected by the Owner's Project Manager.

Sink Supports, where required, shall be of a cradle type consisting of two 1-1/4" x 1-3/4" horizontal cleats and adjustable leveling bolts or glides. The horizontal cleats shall be supported



by two 3/4" x 2-1/2" hardwood plywood cleats attached to the cabinet end panels, or by four 1/4" steel rods attached to the cabinet top frame.

Support struts shall consist of two 16 gauge channel uprights fastened top and bottom by two adjustable "U" shaped spreaders, each 12 gauge, 1-1/2" x length required. Struts shall be furnished to support drain troughs, and to support work top at plumbing space under fume hood superstructures or other heavy loads. They shall be fabricated so as to accept industry standard, pipe and conduit hangers.

Worksurfaces

Acceptable work surface materials in a laboratory setting are stainless steel, epoxy resin, and phenolic resin. Solid surface and plastic laminate are not acceptable.

EPOXY RESIN:

Epoxy Resin Tops shall consist of modified epoxy resin that has been especially compounded and cured to provide the optimum physical and chemical resistance properties required of a heavy-duty laboratory table top. Tops and curbs shall be a uniform mixture throughout their full thickness, and shall not depend upon a surface coating that is readily removed by chemical and/or physical abuse. Tops and curbs shall be non-glaring. Tops shall be 1" thick, exposed edges beveled top and bottom, and drip grooves provided on the underside at all exposed edges. 4" high curbs at the backs and ends of tops shall be 1" thick (unless approved to be 3/4" thick by the Owner's Project Manager) and bonded to the deck to form a square watertight joint. Sink cutouts shall be smooth and uniform without saw marks with the top edge beveled. The bottom edge of the sink opening shall be finished smooth with the edge broken to prevent sharpness. Corners of sink cutouts shall be radiused not less than 3/4".

Provide an end curb where epoxy tops abut walls, casework, or a fume hood.

Joints in epoxy resin tops should be coordinated with cabinet ends where possible. Do not seam epoxy tops over the center of a base cabinet. Provide tops in the longest possible length.

Tops shall be checked for warpage prior to installation. Top will be acceptable for use if warpage does not exceed 1/16 inch in a 36 inch span or 3/32 inch in a 96 inch span.

STAINLESS STEEL:

Provide 16 gauge, type 304 stainless steel with a number 4 finish over a hardwood perimeter frame with a total thickness of 1 inch, unless otherwise required.

Finish and make all cut outs at the factory. Provide tops with 1/2 inch return flange under frame and 16 gauge reinforcing channels applied to underside of top where necessary to ensure rigidity. Coat underside of top with sound dampening material.

Form edges and curbs integrally from one sheet of metal. Provide with marine edges at sinks unless otherwise required.



PHENOLIC RESIN:

In lab applications where grow lights are used, consideration shall be given to using 1 inch thick phenolic resin worksurfaces with applied curbs.

Sinks, Cupsinks and Drains

Laboratory sinks shall be integral epoxy or stainless steel. Drop-in or undermount type are acceptable for either, however, undermount is preferred.

Integral epoxy sinks in epoxy worksurfaces shall be molded of modified epoxy resin, carefully compounded with selected materials to provide maximum physical and chemical properties. Sinks shall be non-glaring with all inside corners coved and the bottom pitched to the drain outlet. Sinks shall possess a high resistance to mechanical and thermal shock.

MOLDED EPOXY RESIN CUPSINKS AND DRAINS:

Molded Epoxy Resin cup drains shall be molded in one-piece of the same resin as specified for Molded Epoxy Resin sinks. They shall have an integral mounting flange.

Provide cupsinks with stainless steel removable splash guards, removable disc strainer, and tailpiece.

STAINLESS STEEL SINKS:

Provide minimum 18 gauge, type 304 stainless steel, number 4 polish. All sinks joints shall be butt welded, ground smooth and polished to render all joints seamless. Reinforce faucet holes with 16 gauge stainless steel hat channel on the underside.

Provide stainless steel sinks with the following accessories: stainless steel drain outlet, stainless strainer, and tailpiece.

Service Fittings and Accessories

Laboratory Service Fittings: Service fittings shall be laboratory grade, and water faucets and valve bodies shall be cast red brass alloy or bronze forgings, with a minimum content of 85%. All fittings shall be chromium plated unless specified otherwise.

All fixtures shall be assembled at the factory and individually tested. Valves and fixtures, except water fixtures, shall withstand a test pressure of 100 pounds per square inch. Test water fixtures at 80 pounds per square inch. Test fixtures for gases under water.

Service Indexes:

Fittings shall be identified with service indexes in the following color coding:

Hot Water	Red
Cold Water.....	Dark Green
Gas.....	Dark Blue
Air.....	Orange
Vacuum.....	Yellow
Distilled Water.....	White
Steam.....	Black
Nitrogen.....	Brown



Oxygen.....	Light Green
Hydrogen.....	Pink
Special Gases.....	Light Blue

Construction:

Water fittings shall be provided with a renewable unit containing all operating parts which are subject to wear. The renewable unit shall contain an integral volume control device and all faucets shall be capable of being readily converted from compression to self-closing, without disturbing the faucet body proper. Four (4) arm forged brass handles shall contain plastic screw-on type colored service index buttons.

Steam fittings shall have a black, heat resistant composition handle, and shall be the heavy pattern design with stainless steel removable seat and flat Teflon seat disc. They shall have Teflon impregnated packing, and shall be so constructed that they can be repacked under pressure.

Distilled water fittings shall be fabricated with a brass exterior and an interior lining of inert polypropylene. All components in contact with pure water shall be polypropylene. Valves shall be manual or self-closing type and shall have a brass stem and valve bonnet, an elastomeric diaphragm and a removable serrated hose end.

Ground Key Valve Hose Cocks: Ground key type valves shall have forged body with 10 serration hose end. Handle plug shall be forged brass, long, tapered type with screw-on colored service index button. Valves shall be individually ground, lapped and sealed.

Needle Valve Hose Cocks: Needle type valves shall have a stainless steel replaceable floating cone, precision finished and self-centering. Cone locates against a stainless steel seat, easily removable and replaced with a socket wrench. Valve shall have "TEFLON" impregnated packing and designed so unit can be repacked while under pressure.

Gooseneck outlets shall have a separate brazed coupling to provide a full thread attachment of anti-splash, serrated tip or filter pump fittings.

All valves for remote control use shall be as previously specified, but shall be complete with aluminum extension rods, escutcheon plates, brass forged handles and screw-on type colored service index button.

Provide vacuum breakers integral to the goosenecks where required. Vacuum breakers shall have a forged brass body, renewable seat and a special design valve member for fine control.

Aerator type outlets shall be furnished for all gooseneck water faucets not furnished with serrated hose connectors.

Provide wrist blade handles at all ADA locations.

Electrical Fittings:

Electrical fittings shall contain 20 Amp., 125 Volt AC, 3-wire polarized grounded receptacles, unless otherwise specified. Pedestal and line-type boxes shall be of aluminum, metallic finish



with stainless steel flush plates. Receptacle boxes shall be of plated steel. All electrical or conduit fittings called for or to be furnished under these specifications shall meet the requirements of the National Electrical Code.

END OF SECTION



DIVISION 13 00 00 - SPECIAL CONSTRUCTION

No specific requirements – design and material recommendations per design Consultant's professional expertise.

All items shall be coordinated with the GSU Project Manager.

END OF SECTION



DIVISION 14 00 00 - CONVEYING EQUIPMENT

ELEVATORS

Design Considerations:

Use non-combustible construction for elevator hoistways and machine rooms. Provide a minimum two-hour fire rating for hoistways and elevator machine rooms.

Hoistways 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.

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

Provide key locks for independent service, fire service inspection, emergency stop, lights and fan. (Provide four [4] keys for each lock). Provide MEDECO (sole source) keys as University standard. Key numbers will be provided by University. THE FIRE KEY S FEOK1.

Machine room-less elevators are unacceptable.

Provide fire service to meet standard ASME A17.1, 2 & 3 – latest adopted version with Georgia Amendments.

Elevator access to penthouse mechanical rooms and similar spaces shall be programmed and/or key-controlled to limit entry to authorized personnel only. Keying shall be coordinated with GSU Key Control.

For hydraulic elevators, provide safety sleeve for jack. Use safety oil only.

Approved manufacturer for all controllers shall be Motion Control Engineering or Galaxy.

Proprietary equipment is unacceptable.

All piping, wiring and equipment installed in the elevator machine room and the elevator hoistway shall be directly related to the elevator.

Provide two extra paired wires and coaxial cable in the travelling cable.

Install lift net monitoring to elevator. Integrate data line and 110 volt outlet for control panel. Contractor to get files for configuration.

Elevator Cabs:

Passenger elevator cabs shall be a minimum of 8'-10" x 6'-0" – consultant shall confirm dimensions will accommodate a stretcher. Capacity shall be 3500 pounds minimum. Minimum door size shall be 3'-6".



Service elevator cabs shall be sized and capacity rated as is appropriate for the building height and use.

All elevators shall have side, double doors. Door finish shall be stainless steel #4 finish.

Buttons: Provide standard GSU flame buttons from Innovation Industries.

Cab Finishes:

Passenger elevators shall have terrazzo or other durable material to match the flooring of the building lobby. For elevator modernization projects, terrazzo tile as manufactured by Nurazzo shall be installed in elevator cabs.

Service elevators shall have diamond-patterned industrial grade steel flooring.

Wall finishes shall be equal to 227 Venetian Horizontal from Chemetal (install horizontally). Equivalent products may be used if approved in writing by the GSU Project Manager.

Elevator cabs shall be equipped with LED lighting.

Provide wall panels in all elevator cabs with hangers for safety pads. Provide safety pads for all elevator cabs. 1 set for each cab.

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

Provide one Ground Fault Circuit Interrupt outlet and associated electrical components in each cab.

Hoistway Entrances:

Hoistway entrances shall be stainless steel with #4 finish.

Signals:

Provide directional indicator lantern lights at each hoistway opening jamb at each floor and car position indicator at main entry levels.

Machine Rooms:

Access to the machine room shall be short and direct from the hoistway unless approved otherwise in writing by the GSU Project Manager. Access shall not be through another secured area which might prevent ready access for emergency and elevator personnel. Access to machine rooms, where applicable, shall be by means of a permanent stair (ladders are unacceptable).

Hydraulic elevator machine rooms shall be located as near as possible to the bottom landing of the elevator.



Traction elevator machine rooms shall be located directly above or as near as possible to the top of the hoistway. The use of a basement type machine must be approved in writing by the GSU Project Manager.

Doors to machine rooms shall be fire rated to match the fire rating of the walls. Doors shall swing out.

Elevator machine rooms shall have conditioned air to maintain ambient temperature and humidity within the middle range specified by the manufacturer.

Deliverables:

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

Inspection and Acceptance Certificates: Include operating permits as required by governing authorities for normal, unrestricted use. Provide 2 copies of "Design Certificates" to the University.

Instruct University's maintenance personnel in the proper use, operation, and maintenance of elevators. 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.

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

INCLINED WHEELCHAIR LIFTS:

Design Considerations:

Provide standard pre-engineered lift systems as follows:

- Rated Capacity: 700 lb (204 kg).
- Rated Speed: 18 fpm (0.10 m/s).
- Power Supply: 120V, 60 Hz, 1 phase.
- Drive System: Battery operated drive with recharging system.
- Manual Lowering: Provide means to manually lower units in case of malfunction or power loss.



- Concealed Wiring: Enclose wiring within housings of units. Do not use conduit exposed to view.
- Automatic Folding Platforms: When not in use, platforms shall automatically fold up against wall to minimize projection into stairway.
- Platform: 0.123-inch (3.1-mm) thick, galvanized steel sheet with black rubber flooring.
- 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.
- Supporting Structure: Provide structural-steel framing to support vertical loads from floor or stair treads and only lateral loads from walls.
- Tubular-steel, manually operated safety arms designed to prevent wheelchair from rolling off platform and to provide grab bar for occupant.

Finishes:

Finishes shall be approved by the GSU Project Manager.

Regulatory Requirements:

Comply with local governing regulations, Part XX of ASME A17.1, "Safety Code for Elevators and Escalators" and Part XXI of ASME A17.1, "Safety Code for Elevators and Escalators".

Maintenance Service:

Maintenance: Beginning at Material 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.

Deliverables:

Provide electronic copy and 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.

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

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.

END OF SECTION



DIVISION 21 00 00 –FIRE SUPPRESSION
FIRE PROTECTION

- 1.1 Provide fire sprinkler system in accordance with NFPA 13 for all new buildings unless directed otherwise by the GSU Project Manager. Provide sprinkler system in renovation/repair projects wherever necessary to meet applicable codes or where requested by the GSU 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 for state owned buildings and Authority Having Jurisdiction for Foundation owned projects.
- 1.3 Contract documents shall require the fire protection Contractor to submit sprinkler shop drawings and hydraulic calculations for approval to the State Fire Marshall for state owned buildings and Authority Having Jurisdiction for Foundation owned projects.
- 1.4 Contractor to coordinate with GSU Fire Safety Officer for fire alarm shut-down.
- 1.5 General Requirements: Each newly constructed building should be protected by a complete and operable automatic wet pipe sprinkler system with 100% sprinkler coverage throughout the entire building. Strong consideration should be given towards sprinkler coverage of non-protected buildings during renovation projects.
- 1.6 Preferred Manufacturers:
 - A. The designer shall specify the following manufacturers as the "basis of design":
 1. Watts backflow preventers.
 2. Viking sprinklers
 3. Peerless fire pump systems.
 4. Joslyn Clark fire pump controllers.
- 1.7 Performance Based Fire Protection Design:
 - A. The intent of the design should be to provide a performance based fire protection design with enough information on the contract documents so that the contractor can accurately bid the project based on the plans and specifications. At a minimum, the performance based design shall provide the following information on the contract documents:
 1. Sizing of fire service to building.
 2. Location/size of backflow preventer.
 3. Sizing of fire pump, if required.
 4. Fire pump room layout.
 5. Type of fire/jockey pump controller.
 6. Sizing/routing of standpipe system.
 7. Location of floor control valves.
 8. Pressure rating of piping and valves.
 9. Location of tamper and flow switches.
 10. Location of fire department connection.
 11. Fire Protection legend and details.



12. Fire Protection design data.

- B. The designer shall require that the contractor assume the following responsibilities:
1. Provide a complete and operable system in accordance with NFPA codes and local regulations.
 2. Provide working drawings in accordance with NFPA codes.
 3. Complete sprinkler piping and head layout downstream of the fire entrance riser or floor control device at each floor level as applicable.
 4. Coordinate routing of piping with other disciplines and building structure.

1.8 Coordination and System Layout:

- A. Sprinkler systems shall be compatible with architectural layouts and to avoid interference with structural, electrical, mechanical, and plumbing work in building.
- B. The designer shall require the sprinkler contractor to keep piping concealed in all areas with ceilings. All piping and equipment shall be located as out-of-the-way as possible, holding all piping and equipment close in corners and to walls. Location of risers and equipment throughout the building shall be shown on the contract documents.
- C. Sprinkler heads shall be symmetrically located as required to provide proper coverage and to avoid interference with lights, diffusers, grilles, or other ceiling mounted equipment. Where sprinkler heads are located in a ceiling, use symmetrical head pattern in good relationship with the general ceiling pattern, including ceiling tile where applicable and lights throughout each area. Center sprinkler head in all ceiling tiles.
- D. Each fire riser shall be provided with all necessary equipment and accessories, including but not limited to UL approved isolation valves, alarm check valves, gauges, test lines with gate valves, water flow alarm switches and valve tamper switches.

1.9 Hydraulic Calculations:

- A. All piping shall be hydraulically sized based on the available water supply and the sprinkler system's total water demand. The size of the fire pump (if required) and the size of the fire main serving the building shall be verified by a current flow test and hydraulic calculations conducted by the designer.
- B. The designer shall also obtain a flow test that records, over a 24-hour weekday period on a 24-hour chart recorder, the water system static pressure in the area of the project and adjust the hydraulic calculation data accordingly. A copy of the 24-hour static pressure shall be included with the hydraulic calculations submittal. The static and residual pressures on the actual flow test shall be adjusted based on the 24-hour static pressure recorder. All flow tests shall be performed in accordance with NFPA 13.
- C. Sprinkler system hydraulic calculations shall be based on the following criteria:
1. Occupancy classification.
 2. Density.
 3. Hydraulic remote area.
 4. Sprinkler orifice size.



5. Hose stream allowance.
- 1.10 Products and Components: All products and components installed in the system shall be listed by Underwriters Laboratories (U.L.) and approved by Factory Mutual Engineering (FM).
- 1.11 Backflow Prevention: A double detector check valve assembly shall be installed above grade in the mechanical room when possible. Installation of backflow preventers below grade in pits shall be avoided if possible.
- 1.12 Piping Materials:
 - A. Exterior fire main - Ductile iron, cement lined. Provide concrete thrust block anchors for underground tees, plugs, caps, and bends in accordance with NFPA 24. Provide rods and clamps on fittings located underground inside building.
 - B. Interior sprinkler piping - Schedule 40 seamless black steel piping (ASTM A53, Grade B) with 150 lb. malleable fittings up to 1-1/2" and Schedule 40 seamless black steel piping (ASTM A53, Grade B) with 150 lb. malleable fittings for 2" and above. Schedule 40 seamless black steel piping (ASTM A53, Grade B with 150 lb. malleable fittings) for dry-pipe type systems. Use threaded joints for spaces with wide temperature ranges.
 - C. CPVC (plastic) sprinkler piping is prohibited.
- 1.13 Sprinklers:
 - A. Sprinklers below finished ceilings shall be pendent 1/2-inch orifice, UL listed types having a chrome finish. Temperature rating shall be 165°F. Minimum K value shall be 5.6. Provide chrome plated recessed escutcheons where recessed light fixtures are furnished. Provide standard escutcheons where surface mounted light fixtures are provided.
 - B. Sprinklers in areas having no finish ceilings shall be standard upright, 1/2-inch UL listed 165°F temperature rated types having brass finish, except in mechanical rooms and near heaters or duct outlets where sprinklers having an intermediate temperature rating shall be used. Minimum K value shall be 5.6.
 - C. In architecturally sensitive areas, sprinklers below finished ceilings shall be concealed pendent 1/2-inch orifice, UL listed types having a white cover plate. Temperature rating shall be 165°F. Minimum K value shall be 5.6.
 - D. Temperature rating: Release element of each head shall be of the ordinary temperature rating 160-165 degrees or higher as suitable for the individual location where the head is installed except release elements for sprinkler heads in the mechanical rooms and similar areas shall be high temperature rating, 286 degrees minimum. Sprinkler heads subject to high temperature caused by unit heaters, hot pipes, radiant ceilings, or other heat sources shall be of high temperature rating or higher.
- 1.14 Flow/Tamper Switches:
 - A. The location of all flow switches, pressure switches and valve supervisory switches shall be shown on the drawings and coordinated with the electrical drawings.



- B. Water flow indicators: Water flow indicators shall be the pressure or paddle type as required, and shall be equipped with a self-winding, adjustable, recycling, non-thermal type signal retarding device to prevent false alarms due to surges in the water system. Paddle type flow switches shall not be utilized on dry pipe systems.
- C. Valve supervisory switches: Provide sprinkler control valves including post or wall indicating valves with approved circuit supervisory (tamper) switches.

1.15 Fire Pump Systems:

- A. Where required, a fire pump system shall be provided complete with fire pump, jockey pump, drives, automatic controllers, and necessary accessories. Fire pump, automatic controller and all accessories shall comply with the requirements of NFPA 20.
- B. The fire pump shall be a horizontally split case double suction, centrifugal type pump, bronze fitted with Class 35 minimum cast iron casing for 175 psi working pressure.
- C. Pump controller/transfer switch: The designer shall conduct short circuit calculations to determine the minimum short circuit rating for the fire pump controller and transfer switch. The controller and transfer switch shall be service entrance rated and be over current protected per NFPA 20. A transfer switch shall be provided as an integral part of fire pump controller. The entire package shall be factory assembled with the fire pump controller for applications requiring a fire pump emergency power source.

1.16 Submittals:

- A. The designer shall require the sprinkler contractor to provide the following:
 - 1. Prepare and submit a minimum of one complete reproducible set of detailed working drawings in accordance with NFPA 13 and manufacturer's catalog data and specifications showing equipment, underground fire service lines, risers, hangers, piping, and heads. These drawings shall be approved in writing or stamped approved by the Authorities Having Jurisdiction, and State Fire Marshal, before submitting to the Engineer.
 - 2. Furnish two instruction manuals and one flash drive containing complete operation and maintenance instructions for the specific make and model of all equipment furnished.
 - 3. On a daily basis, the sprinkler contractor's superintendent, shall review and record as-built conditions on a set of drawings maintained at the job site.

END OF SECTION



DIVISION 22 00 00 – PLUMBING

- 1.1 Flush valve and fixture manufacturer shall match. Toto EcoPower is preferred brand of flush valves, plumbing fixtures, and trim. Other manufacturers can be used at project manager's discretion. Provide self-power generating battery sensor flush valves. Use 0.125 gallon per flush for urinals. Use 1.28 gallon per flush for water closets. Use wall-hung water closets and urinals where feasible. Match flush valve to toilet manufacturer's requirements.
- 1.2 Countertop lavatories are preferred in restrooms with undermount sinks. Under counter sinks shall use white vitreous china. Lavatories must be designed for current ADA requirements. Toto Model #T28S53 with self-generating hydro-powered ECOPOWER system is the preferred faucet. Other manufacturers can be used at project manager's discretion. Faucets shall be self-power generating battery sensor type.
- 1.3 Wall-mounted lavatories shall use white vitreous china, based on Toto. Lavatories designed for ADA use shall be mounted at the designated height by current ADA requirements. Toto Model #T28S53 with self-generating hydro-powered ECOPOWER system is the preferred faucet. Other manufacturers can be used at project manager's discretion. Faucets shall be self-power generating battery sensor type.
- 1.4 Provide hose bibb in restrooms with security key for operation.
- 1.5 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.
- 1.6 Oasis water coolers are preferred. Second preference is Elkay.
- 1.7 Do not permit use of galvanized water pipe.
- 1.8 Provide shutoff valves on utilities outside building and accessible isolation valves at each floor or restroom.
- 1.9 Include insulation of rainwater drainage system horizontal runs from roof drain (interior) leaders.
- 1.10 Provide air chambers or shock absorbers at plumbing fixtures on quick closing valves.
- 1.11 Provide domestic water supply (hose bibb) at cooling towers and in mechanical rooms, including AHU rooms, for maintenance purposes.
- 1.12 Boilers and cooling tower make up water supplies shall have slow acting valves to prevent water hammer.
- 1.13 Process Water Piping: Deionized water and Reverse Osmosis piping shall be polypropylene pipe, Aquatherm preferred. Faucets need to have non-conductive type material.
- 1.14 Provide shut off valves for all services into laboratory spaces to allow for single labs to be isolated. Mechanical piping identification shall comply with current ANSI standards.
- 1.15 Domestic hot water shall be a re-circulating type system. Point of use systems can be used as approved by the GSU Project Manager.
- 1.16 General Requirements:
 - A. Exterior wall hydrants will be provided as determined by the GSU Project Manager.
 - B. All floor drains shall be provided with trap primers.



1.17 Preferred Manufacturers:

- A. The designer shall specify the following manufacturers as the "basis of design":
 - 1. Watts backflow preventers.
 - 2. Watts pressure reducing stations.
 - 3. Syncroflo water booster pump stations.
 - 4. PVI domestic water heaters.
 - 5. Weil sewage lift stations.
 - 6. Fuseal acid waste drainage piping.
 - 7. Ingersoll Rand air compressors.
 - 8. Toto plumbing fixtures.

1.18 Backflow Prevention:

- A. The designer shall coordinate the backflow prevention design with the local water department and the Institution. A reduced pressure zone backflow preventer shall be installed above grade in the mechanical room when possible with drain to outdoors. Installation of backflow preventers below grade in pits shall be avoided. Reduced pressure zone backflow preventers shall not be installed below grade. If absolutely necessary, below grade backflow preventers shall be double check valve assemblies.
- B. A branch line fitted with a reduced pressure zone backflow preventer shall be provided to serve as the makeup water source for any mechanical water requirements. The system downstream of this device shall be designed under the HVAC division of the project.

1.19 Water Supply Pressure Control:

- A. Pressure reducing stations:
 - 1. Pressure reducing valves shall be required at all domestic water entrances. Duplex pressure reducing stations shall be considered and discussed with the GSU Project Manager.
- B. Water booster pump system:
 - 1. Existing water supply systems that cannot meet the proposed system demand shall be equipped with the necessary water pressure booster pump sets. Water pressure booster systems should be considered for entire buildings with adequate flows and pressures to support all operations. The evaluation of the public main should also consider the potential for future building expansion and the effect that that expansion will have on the water supply. Pressure reducing stations are not required on buildings with water booster pump systems.
 - 2. The system controls should be of the programmable microprocessor based type to allow for field adjustments.



1.20 Domestic Water Systems:

- A. Domestic water piping shall be Type L hard drawn copper tubing for above grade and Type K hard drawn copper tubing for below grade. Joints in 2-1/2" and smaller piping shall be soldered using 95/5 lead free solder. Joints in 3" and larger piping shall be brazed. The designer shall require that during brazing, the piping be purged of oxygen with nitrogen to prevent oxidation inside the piping. Pro-press piping is allowed in areas where piping is accessible.
- B. Domestic cold, domestic hot and domestic hot return piping shall be insulated with fiberglass pipe insulation and an all service jacket to conform to the requirements of the current Georgia State Energy Code.

1.21 Domestic Water Heaters:

- A. The water heating equipment shall be set to provide between 110 and 120°F hot water for general distribution.
- B. For kitchens and systems with showers, the water heating system shall be designed to store water at 140°F. When storing water at 140°F, a mixing valve shall be utilized to blend the hot water down to 120°F for general distribution.
- C. Water heating systems with remote fixtures located more than 50 feet away shall be provided with a circulation pump.

1.22 Sanitary Sewer Systems:

- A. The designer shall specify that the sanitary drainage system should be constructed using cast iron soil pipe and fittings with heavy duty no-hub type couplings for aboveground installations. For underground installations, cast iron soil pipe and fittings with push-on type bell and spigot joints is preferred.
- B. Where installation conditions do not allow for gravity drainage to the site collection system, sanitary lift stations shall be employed. The lift station shall include duplex pumps with the necessary controls. The package should also include alternators to exercise both pumps equally. The controls should also provide means for interface with the building energy management control system at the trouble and level alarms as a minimum.

1.23 Storm Drainage: The designer shall specify that the storm drainage system should be constructed using cast iron soil pipe and fittings with heavy duty no-hub type couplings for aboveground installations. For underground installations, cast iron soil pipe and fittings with push-on type bell and spigot joints is preferred.

1.24 Laboratory Drainage Systems: The use of acid neutralization tanks and acid piping shall not be used. The Owner does not allow the drainage of chemicals on campus.

1.25 Laboratory Compressed Air Systems:

- A. Compressed air should be generated by central equipment consisting of duplex air compressors complete with all required control panels. Each compressor shall support 100% of the design load. Controls shall include automatic alternators for the electric motors on this equipment. Certified oil carry over free.



- B. Air drying equipment shall be provided to maintain a pressure dewpoint of 35 degrees F maximum in the system.
- C. Particulate shall be removed from the compressed air stream by using replaceable cartridge type filters. The particle size of the filter should be 1 micron minimum and should be discussed during design to determine any additional requirements.

1.26 Laboratory Vacuum Systems:

- A. Labs using radioactive material shall not use centralized vacuum pumps.

1.27 Natural Gas Systems:

- A. Cast iron, copper, brass or plastic pipe and fittings shall be avoided in natural gas piping systems. 2" and larger piping shall be welded black steel, 1-1/2" and smaller shall be threaded black steel. Pipe with malleable iron fittings or other approved materials in conformance with standards for metallic pipe should be used.
- B. In general, the natural gas distribution system shall be designed to provide 2 cubic feet per hour at each laboratory outlet at a pressure of 7 inches water column. A diversity, if safely established, may be used for the laboratory outlets, but the equipment shall be considered at 100% use factor.
- C. In general, gas piping shall be routed exposed or in accessible areas. Piping should not be routed through tunnels or confined spaces where leaking gas could accumulate.
- D. The system shall be separated into zones by the use of isolation valves. Each floor of a building shall be separated from the main by an isolation or zone valve. Isolation valves for each laboratory are required. Emergency gas shut off buttons shall be provided at the exit doors from each laboratory.

1.28 Plumbing Fixtures:

- A. Emergency shower/eyewash: Floor or wall mounted stainless steel and located throughout the facility where hazardous locations exist. Emergency fixtures shall receive cold water only.
- B. Breakroom and kitchen Sinks: Single compartment, countertop mounted stainless steel with single lever controls and hose and spray.

END OF SECTION



SECTION 22 05 23
PLUMBING VALVES AND STRAINERS

- 1.1 Gate valves are not allowed.

END OF SECTION



SECTION 22 07 00
PLUMBING INSULATION

1.1 Domestic Water Piping:

- A. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover. PVC jacket will be acceptable on indoor applications.
- B. Specify pre-molded insulation under lavatories to meet ADA requirements.

1.2 Process Water Piping: 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.

END OF SECTION



SECTION 22 14 31
SUBMERSIBLE SUMP PUMP

1.1 Elevator Sump Pump:

- A. Provide sump pump with elevator pump control system with oil / water detection. The pump control shall activate the pump for removal of water in accordance with ASME17.1. The control shall shut-down the pump prior to discharging oil.
- B. Pump shall be a close coupled submersible type simplex pump with cast iron motor housing and volute, bronze impeller, stainless steel shaft, armored power cord and operating switch of waterproof construction.
- C. Sensor to include ABS housing, stainless steel probe and PVC float.
- D. Control panel shall include NEMA type 1 enclosure, 6-foot power cord and receptacle.
- E. Alarm panel shall include NEMA type 1 enclosure, plug-in transformer, battery back-up power, LED alarm indicators and audible alarm with buzzer, auto test and reset.
- F. Pump shall be Myers EPP series or equal by Stancor Oil-Minder, Liberty OilTector or Zoeller Oil Smart System.

END OF SECTION



SECTION 22 34 00
DOMESTIC WATER HEATING EQUIPMENT

- 1.1 High efficiency domestic type. Natural gas condensing or electric based on project.

END OF SECTION



DIVISION 23 00 00—MECHANICAL GENERAL

1.1 Design Conditions:

- A. Outside design conditions shall be as indicated in the ASHRAE Fundamentals Handbook, current edition. Cooling Tower design condition selection shall be as indicated under the 1% Design Wet-Bulb column for 78°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 unless otherwise directed.
 - 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 DB.
 - 8. Research facilities may have special temperature and humidity requirements. These special conditions defined by GSU shall be given to the design team at the start of the project.
- C. Winter inside design condition shall be 70°F for occupied spaces and 65°F(min.) for unoccupied spaces, unless noted otherwise. Spaces shall be allowed to night setback to 65°F(min.).

1.2 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. Building heating and cooling load calculations shall be by an approved software program. eQuest is currently not an approved software program for building heating and cooling load calculations.

1.3 Outside Air Ventilation Requirements: Follow latest editions of ASHRAE Standards.

1.4 Deliverables

- A. Each project shall have the project specific design intent located on the contract documents.
- B. If Entire Building Energy Modeling is required for the project, the input and output from the Energy Modeling shall be provided to GSU at project completion.

1.5 Provide ample service access to equipment for maintenance. Maintenance access for adjacent items of equipment may be "shared". Clearances for airflow between adjacent items of equipment shall not be "shared".



- 1.6 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.
- 1.7 Specify chilled water coils when chilled water is available. Only special application where chilled water system is not available or cost prohibitive then DX coil AHU may be considered.
- 1.8 All refrigeration equipment shall use refrigerants that minimize or eliminate emission of compounds that contribute to ozone depletion and global climate change.
- 1.9 All HVAC air and water systems require a certified Test and Balance report.
- 1.10 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.
- 1.11 Specify re-heat coils on all air handling units where RH (Relative Humidity) maximums are to be controlled.
- 1.12 Motors shall be provided with shaft grounding rings from the factory when connected to Variable Frequency Drives.
- 1.13 Coordination Issues: Permanent roof access shall be provided in all buildings that contain mechanical equipment on the roof. Vertical ships ladders are not acceptable.
- 1.14 Steam boilers' automatic surface blowdowns shall have stainless steel trimmed motorized ball valves.
- 1.15 Use Spence Engineering Company steam pressure reducing valves with low pressure relief valve vented to the outside.
- 1.16 Use cast iron reservoir duplex condensate return pumps with SS impeller and stem. Vent these to the outside.
- 1.17 Condenser water makeup, condenser water blowdown, and boiler make-up lines shall have meters for recording water used for evaporation.
- 1.18 Chemical water treatment shall be project specific, consult with the GSU Project Manager. Condenser water chemical treatment shall use Smart Release Technology.
- 1.19 Require cleaning of all piping systems prior to initial operation including chilled water, condenser water, hot water, steam, domestic and fire protection systems.
- 1.20 Stairwell pressurization fans and smoke exhaust fans shall be direct drive only. Belt-driven fans will not be acceptable.
- 1.21 Ventilation fans for mechanical rooms containing gas-fired boilers or domestic water heaters shall be supply type, not exhaust. This shall not conflict with the exhaust requirements to comply with ANSI/ASHRAE Standard 15.
- 1.22 Space humidification, when required, shall not use boiler steam directly. Indirect devices such as steam-to-steam heat exchangers shall be provided.
- 1.23 IT Data rooms and Elevator Machine Rooms shall use stand-alone DX units for 24/7 cooling. Base building systems shall not be used.

END OF SECTION



SECTION 23 05 00
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 piping (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 large chilled and hot water coils shall have ports and valves to support temperature and pressure difference measurement. Measurement items include thermometers, pressure gauges, DDC temperature sensors, and Pete's plugs.
- 1.5 Valves shall be single domestic manufacturer.
- 1.6 Provide vibration isolation for equipment where needed.
- 1.7 All-thread nipples larger than 1-1/2" in diameter are prohibited. Nipples attached to larger pipes shall be Schedule 80 attached with the use of threadollets or weldollets.
- 1.8 Branch lines from piping mains should come off the top half of the main pipe.
- 1.9 Mitered fittings and tapped pipes are not allowed.
- 1.10 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 in accessible locations for ease of maintenance.
- 1.11 Reducers in piping shall be eccentric type where grading is specified, (reducers shall be used to change pipe size).
- 1.12 Relief valves or devices discharge piping shall be piped to a drain.
- 1.13 Preferred Manufacturers:
 - A. The designer shall specify the following manufacturers as the "basis of design":
 1. a. Bell and Gossett pumps.
 2. b. Belimo valve and damper actuators.
 3. c. Watts backflow prevention devices.



1.14 System Types – General Requirements:

- A. B. The use of variable air volume (VAV) systems is encouraged wherever there exists the need for thermal or occupancy zoning. Preferred design is parallel PIUs (without heat in interior zones) for offices, instructional space, conference rooms and similar spaces. In a renovation consider the use of PIUs unless project space constrictions do not allow.
- B. VAV systems shall employ modulating outdoor air and exhaust (or relief) dampers to ensure that the code-required minimum outdoor air is maintained throughout the range of supply fan modulation.

1.15 Maintenance Access Requirements:

- A. The designer shall clearly indicate on the floor plans, sections, and elevations all required maintenance access clearances to mechanical equipment using dashed lines and appropriate notes. As a minimum, the following shall be shown:
 - 1. Chiller tube cleaning/removal clearances.
 - 2. Boiler tube cleaning/removal clearances.
 - 3. Manufacturer's recommended clearances for airflow around cooling towers, condensing units, air-cooled condensers, dry coolers, packaged rooftop equipment, etc.
 - 4. Manufacturer's recommended clearances for maintenance access around all mechanical equipment, including devices installed above ceilings.
 - 5. Door swings on all control panels and access panels, including devices installed above ceilings.
- B. The designer shall carefully coordinate required maintenance access clearances with the electrical, plumbing, fire protection, architectural and structural trades.

1.16 Chiller room shall comply with ASHRAE 15.

END OF SECTION



SECTION 23 05 14
VARIABLE FREQUENCY DRIVE

1.1 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

1.2 Preferred Manufacturers: Danfoss/Graham, ABB, Square D, Toshiba, and Yasakawa/MagneTek.

1.3 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 disconnects 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 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.
- C. VFD shall design to operate at full load with ambient conditions between 40°F and 104°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, 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.
- D. The VFD and options shall be tested to ANSI/UL Standard 508.



- 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 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.
 - H. Bypass:
 - 1. Provide manual bypass for special applications as required. Verify with the GSU Project Manager.
 - 2. Provide a manual bypass consisting of a door interlocked main fused disconnect.
 - I. 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.
- 1.4 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: 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.

END OF SECTION



SECTION 23 05 20
PRESSURE GAUGES AND VALVES

- 1.1 Gauges shall be manufactured by Ashcroft, Marsh, Moeller, Terice, or Weksler.
- 1.2 Gauges shall be ANSI Grade A, liquid-filled, dial indicating type, with 4½" dial and stainless steel case, Plexiglas cover and ring. Bearings shall be bronze. Accuracy shall be within 1% of full scale range.
- 1.3 Pressure ranges of gauges shall be as follows:

Unless otherwise specified:	0-160 psig
Pump suction:	30" vacuum-160 psig
Pump discharge:	0 to 160-300 psig
Domestic water supply:	0-160 psig
Top of standpipes:	0-160 psig
- 1.4 Needle valves shall be made of brass with Teflon packing.
- 1.5 Gauge cocks shall be polished brass 200 psi rated cocks with lever handle.
- 1.6 Gauges shall be installed upright in a vertical plane when not more than seven feet (7') above the floor. Provide a gauge cock at each pressure gauge installation.

END OF SECTION



SECTION 23 05 21
TEMPERATURE GAUGES AND TEST WELLS

- 1.1 Provide thermometers at all AHUs, boilers, chillers, heat exchangers, and other large HVAC equipment.
- 1.2 Thermometers shall be manufactured by Ashcroft, Marsh, Moeller, Trerice, or Weksler. Test wells shall be by same manufacturer. Mercury thermometers are not acceptable. Digital thermometers are acceptable.
- 1.3 Thermometers shall be industrial type with 9" aluminum case, every angle adjustment mount, plexiglass cover, 6" stem, and separable brass socket with 2½" lagging extension.
- 1.4 Temperature range of thermometers shall be as follows, unless otherwise specified:

Air Ducts:	30°-130°F.
Chilled Water Piping:	30°-130°F.
Cooling Tower Water Piping:	30°-130°F.
Tempered Water Piping	30°-130°F.
Hot Water Piping:	30°-300°F.
- 1.5 Thermometers shall be located and installed to be conveniently read from the floor.
- 1.6 Wells shall be installed vertical or inclined and filled with light oil.
- 1.7 Test wells shall be brass with brass plug and chain. Wells shall have 2½" lagging extension.
- 1.8 Test plugs shall be solid brass temperature and pressure test station, ¼" NPT size, standard length, Nordel valve core, manufactured by Peterson Equipment Company Inc. Furnish a test kit consisting of 0-100 psi pressure gauge, gauge adapter, 25°F-125°F pocket thermometer and protective carrying case.

END OF SECTION



SECTION 23 05 29
EQUIPMENT SUPPORT

- 1.1 All mechanical equipment located in mechanical room shall be on 4-inch high (minimum) concrete equipment pads.
- 1.2 All mechanical equipment located on the roof shall be located on roof curbs or equipment rails.
- 1.3 All mechanical equipment located on the roof such as piping, air cooled chillers, etc. shall be above the roof surface at a minimum of 24" inches to allow re-roofing.

END OF SECTION



SECTION 23 05 53 IDENTIFICATION OF HVAC PIPING AND EQUIPMENT

- 1.1 Mechanical Equipment Labeling: Equipment nomenclature shall be as follows:
Equipment Type - Floor Number - Sequential Numbering (based on existing equipment, as applicable). For example, Air Handling Unit on the first floor, number 4 shall be labeled as AHU-1-4. Verify all labeling nomenclature with GSU.
- 1.2 Provide Bakelite nameplates on all major equipment, such as air handling units, chillers, boilers, terminal units, motor starters, remote push button stations.
- 1.3 Provide manufacturer's standard 1/16" engraved equipment tags matching the terminology on schedules as closely as possible. Use black with white letters, 1" x 3" or 1 1/2" x 4" for control devices, dampers, and valves and 4" x 6" for equipment. Use green with white letters, 3" long x the ceiling grid width for equipment above lay-in ceilings.
- 1.4 Schedule of Piping Identification:

Piping Systems and Contents	Tape Background Color	Stenciled Legends
<u>Water Supply</u>		
Heating Hot Water	Yellow	Hot Water Supply/Return
Chilled Water Supply/Return	Blue	Chilled Water
Condenser Water	Green	Condenser
Fire Protection	Red	Fire Protection Water
Domestic Cold Water	Green	Cold Water Domestic
Domestic Hot Water	Yellow	Hot Water Domestic
Recirculating	Yellow	Hot Water Recirculating
<u>Gas Systems</u>		
Gas	Yellow	Natural Gas
Lab Air	Blue	Compressed Air
Medical Air	Yellow	Medical Air
Lab Vacuum	Green	Vacuum
Medical Vacuum	White	Medical Vacuum
Oxygen	Green	Oxygen
Carbon Dioxide	Gray	Carbon Dioxide
Helium	Brown	Helium
Nitrogen	Black	Nitrogen
Nitrous Oxide	Blue	Nitrous Oxide
<u>Fuel</u>		
Fuel Oil Supply	Yellow	FOS
Fuel Oil Return	Yellow	FOR
Fuel Oil Overflow	Yellow	FOO
Gasoline Fill Cover	Red	Fill-Gasoline
Diesel Fill Cover	Yellow	Fill-Diesel



Kerosene	Brown	Fill-Kerosene
<u>Steam</u>		
Steam	Yellow	Steam
Condensate	Yellow	Condensate
Pumped Condensate	Yellow	Pumped Condensate
<u>Drainage</u>		
Sewerage	Green	Sanitary Sewer
Waste	Green	Waste
Roof Drainage	Green	Rainwater
Vent	Green	Vent

- 1.5 Pipe markers shall be pressure-sensitive type. Provide manufacturer's standard preprinted, permanent adhesive, color-coded pressure sensitive vinyl labels complying with ANSI A13.1. Color-coded plastic adhesive flow directional arrow tape, full circle at both ends of the pipe marker, tape overlapped 1-1/2". Use 1" tape for piping less than 2-1/2", 2" tape for 2-1/2" thru 8" piping, and 4" tape for larger piping. Comply with ANSI A 13.1 for piping system nomenclature. Abbreviate only as necessary to accommodate marker length.

1.6 Valve Tags:

- A. Provide manufacturer's standard 1/16" brass engraved tags, 1 1/2" square, engraved lettering. Use solid brass "S" hooks for installation of valve tags.
- B. Provide a valve tag on every cock and control device in each piping system. Exclude check valves, valves within factory fabricated equipment units, plumbing fixture faucets, convenience and lawn watering hose bibbs, shut-off valves at plumbing fixtures. List each tagged valve in a valve schedule for each piping system.

1.7 Schedule of Piping Paint Color (Note that painting of copper piping is not required):

Piping Systems and Contents	Paint Color
<u>Water Supply</u>	
Heating Hot Water	Yellow
Chilled Water	Blue
Condenser Water	Light Green
Fire Protection	Red
Domestic Cold Water	Green
Domestic Hot Water	Yellow
Recirculating	Yellow
<u>Fuel</u>	
Gas	Yellow
Fuel Oil Supply	Yellow
Fuel Oil Return	Yellow
Fuel Oil Overflow	Yellow



Secondary Containment (Steel)	White
Vent (Above grade paint)	White (treat galvanized piping to accept paint)
Monitor Well Cover	White with Black Triangle
Manhole Cover	Gray
<u>Steam</u>	
Steam	Yellow
Condensate	Yellow
Pumped Condensate	Yellow

END OF SECTION



SECTION 23 07 00
MECHANICAL INSULATION

1.1 Ductwork:

- A. Indicate duct sizes by "clear inside dimensions". Do not use internal duct liner with high-pressure systems.
- B. Specify thicker duct insulation in attic spaces, per code.
- C. All square and rectangular ducts regardless of size shall use weld pins to secure the insulation. All round ducts shall use a 2" band of adhesive at two foot intervals to secure the insulation.
- D. Duct liner: No duct liner utilizing fiberglass insulation is allowed. Use closed cell foam insulation for acoustical treatment only.
- E. Use 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.

1.2 Chilled Water Piping:

- A. All chilled water piping shall be insulated 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 or fiberglass pipe insulation with heavy gauge aluminum jacketing from the floor to 8' AFF.
- C. Below ground chilled water piping shall be insulated with factory installed foam glass pipe insulation with jacketing.
- 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. If waterside economizer is utilized, all condenser water piping shall be insulated to prevent moisture condensation, 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 or fiberglass pipe insulation with heavy gauge aluminum jacketing from the floor to 8' AFF.
- C. Below ground condenser water piping shall be insulated with factory installed foam glass pipe insulation with jacketing.



- 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.
 - 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, if required.
- 1.5 Heating Hot Water Piping:** All heating hot water supply and return piping shall be insulated with fiberglass pipe insulation. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.
- 1.6 Process Water Piping:** All process water piping shall be insulated to prevent moisture condensation on exterior surfaces, as required. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.
- 1.7 Equipment Insulation: Chilled Water Equipment:** All chilled water equipment shall be insulated with elastomeric sheet or foam glass to prevent moisture condensation on exterior surfaces. In exposed locations where insulation may be subject to damage, specify a protective aluminum jacket cover.

END OF SECTION



SECTION 23 08 00
MECHANICAL COMMISSIONING

- 1.1 The primary role of the CxP shall be to develop and coordinate the execution of a Commissioning Plan, through the Commissioning Team, that will verify the correspondence among the Owner's Project Requirements (OPR) Document, the Basis of Design (BOD) and other design documents, the construction documents, and the finished facility. In order to accomplish this objective, the CxP will, without limitation, observe and document the installation, checkout, startup, and equipment and system testing to establish that equipment and systems are functioning in accordance with the requirements of the contract documents. The CxP will also assist the Owner in developing correct and complete documentation of the construction effort.
 - A. The CxP will not be responsible for design concept, design criteria, compliance with codes, design, or general construction scheduling, cost estimating, construction management, or construction supervision. The CxP may assist the Design Team with design issues, problem solving, or the correction of construction non-conformance or deficiencies. Ultimate responsibility for meeting the project objectives and requirements resides with the Design Professional team and Constructor.
- 1.2 Commissioning Tasks: The Commissioning Provider will accomplish the following tasks to provide commissioning during the pre-design, design, construction, acceptance, and warranty phases of the project.
- 1.3 Pre-Design Phase: Systems to be Commissioned
 - A. Specific systems that shall be commissioned include the following:
 1. Building Envelope: Insulation, glazing, vapor barriers, all elements of the building exterior wall, roof, and building pressure testing.
 2. HVAC Systems: Air handling units, fan coil units, terminal units, induction units, unit heaters, exhaust systems, energy recovery systems, chilled water systems, heating water systems, steam systems, humidifiers, fire and smoke dampers, heat exchangers, and computer room air conditioning systems.
 3. Life Safety Systems: Fire-resistive ratings, smoke barriers, smoke rating partitions, stair pressurization systems, and fire command center.
 4. Building Automation Systems: Workstation, or BAS server, system graphics and dashboards, BAS networks, controllers, sensors, and meters.
 5. Plumbing Systems
 - a. Domestic cold water system meter, backflow preventers, booster pumps, and water softeners
 - b. Domestic hot water systems, water heater, re-circulation systems.
 - c. Sump pumps
 - d. Natural gas
 - e. Rain water harvesting



6. Electrical Systems: Meter, primary transformers, main switchgear, panel boards, isolated power systems, power conditioners, power factor correction equipment, uninterruptible power supplies, step-down transformers, generators, paralleling switchgear, automatic transfer switches, lightning protection systems, and grounding systems.
7. Fire Alarm System: Workstations, controllers, sensing devices, interface with life safety systems, interface with fire protection systems, voice communication for emergency management, interface with HVAC systems, and interface with elevators.
8. Information Technology: Security systems, intercom systems, public address systems, intrusion alarm systems, access control systems, CCTV systems, and cellular phone repeaters.
9. Fire Protection Systems: Fire pump and jockey pump, backflow preventers, tamper and flow switches, valves, fire department connections, standpipes, sprinkler heads, pre-action systems, and clean agent systems.
10. Interior and exterior lighting: Occupancy sensors, controls, illumination levels, and photo sensors.
11. Vertical Transportation: Elevators, Escalators, and dumbwaiters.

1.4 Design Phase

A. Organize the Pre-design Conference

1. The CxP shall organize and attend a pre-design conference at the beginning of the design phase. The owner's representative, program management representative, architect, engineer, and CM/GC shall attend the conference. The conference establishes the commissioning process for the project and the specific roles and responsibilities of each individual and firm involved.
2. The meeting should establish project goals, scope, team members, and delivery process. The discussion includes the project budget, schedule, and performance expectations.

B. Set Project Energy Efficiency Goals

1. The CxP shall work with design team, CM/GC, program management team, and owner's representative to establish an aggressive yet attainable and fiscally responsible energy efficiency goal. This goal should be set using the Georgia Sustainable Construction act, and the EPA Energy Star construction guidelines.

C. 3) Owner's Project Requirements (OPR)

1. After the project team is established, the CxP shall document the owner's expectations and requirements for the commissioned equipment and systems in writing as Owner's Project Requirements (OPR).

D. The Basis of Design (BOD) for systems to be commissioned

1. After the OPR is complete, the means and methods to be used to incorporate the OPR for the systems to be commissioned into the facility design should be documented in writing. This document is referred as the Basis of Design (BOD). The design team should develop the BOD.



E. Review the OPR and BOD

1. The CxP should review the OPR and BOD and verify that they are comprehensive, specific to the project, and clearly understandable. The CxP also verifies that the OPR identifies all appropriate goals and objectives and that the designs, equipment, and systems identified in the BOD are responsive to the goals and objectives established by the OPR.

F. Review Preliminary Design Documents

1. The CxP should review the documents produced by the design team with a focus on commissionability, completeness, cost-effectiveness, coordination of trades, and energy efficiency.
2. The CxP design reviews should accomplish the following tasks:
 - a. Verify that the design documents are complete and contain the information required for construction, maintenance, and operations;
 - b. Suggest alternative designs that might yield a lower project cost without adversely affecting performance.
 - c. Suggest alternative designs that might reduce energy costs, maintenance costs, durable and low maintenance products, and life cycle costs without unduly increasing the construction cost.
3. The CxP verifies that the documents are consistent with the OPR and BOD and that the proposed design conforms to best practice.

G. Develop the Commissioning Plan

1. The CxP shall develop the facility-commissioning plan for the commissioning team to follow. The plan should be a comprehensive document that describes the commissioning process and how it will be executed. It includes project – specific pre-functional checklists and functional performance test procedures. The commissioning plan includes the following components:
 - a. A brief overview of the commissioning process that addresses the design, construction, acceptance, occupancy, operational, and warranty phases of commissioning.
 - b. List of equipment and systems. Each piece of equipment on the list is associated with a system, including the part of the building served and related systems that interface with it are indicated for each system and piece of equipment. The information on the list should be used to schedule completion of systems and to track completion of the commissioning process.
 - c. A description of the roles of the commissioning team members (The owner's representative, design professionals, contractors, and the CxP).
 - d. A description of the management, communication and reporting of the commissioning process.
 - e. Deliverables – Expected work products of the commissioning process;
 - f. Commissioning milestones - Key milestones of the commissioning process;



- g. Start-up – A matrix defining all start-up requirements of the construction documents.
 - h. Installation checklists – Pre-functional checklists (PFC) for each piece of equipment and system in the scope of communication work;
 - i. Functional testing – Functional performance test (FPT) procedures for each piece of equipment and system that is to be commissioned;
 - j. Training – A list of the training required in the contract scope. Where detailed training plans, scheduling, and coordination with the owner's needs and staff schedules are required;
 - k. Operation and maintenance manuals - A list of the O&M documentation required per the contract scope. When required, this list shall include the detailed format for these documents, specific submission requirements, availability for owner training and so on.
 - l. Opposed season testing and warranty reviews – A list of the opposed season and warranty items that are required, with a definition of the process for monitoring execution of these activities.
- H. Prepare the Commissioning Specifications
 - 1. The CxP shall prepare the commissioning specifications, which define the specific scope of work, roles and responsibilities, and requirements for each member of the commissioning team. The design team inserts the commissioning specifications into the project manual, as the construction team needs to see them to accurately price the cost of the work. At the minimum, the commissioning specifications shall include the following:
 - a. Commissioning team involvement
 - b. Contractor's responsibilities
 - c. Submittals and submittal review procedures for CxP process/ systems
 - d. Operation and maintenance documentation/ systems manual requirements
 - e. Number of project meetings related to commissioning and which commissioning team members are obligated to participate
 - f. Construction verification procedures
 - g. Start-up plan development and implementation
 - h. Functional performance test procedures
 - i. Training requirements, including development of a training plan and requirements of the audio visual documentations
 - j. Warranty review site visit;
- I. Review the Design Development Documents
 - 1. The CxP shall review the design development documents prepared by the design team. The objectives for this review includes:
 - a. Verify consistency with the BOD and OPR
 - b. Verify the CxP and owner comments from the schematic design review have been addressed



- c. Assess whether the space allocation, equipment layouts, maintainability, coordination of systems, and general equipment sizing / capacities in the documents are adequate to meet the owner's needs
 - d. Confirm that redundancy and future capacity issues have been addressed on the drawings
 - e. Verify that the design includes the features needed to execute the CxP's plan
 - f. The CxP also reviews the design development documents with the owner's representatives and documents their comments and concerns. The CxP shall prepare a written list of comments and forwards the list to the owner and the design team. The CxP should follow-up with the design team to ensure that written responses to the review comments are provided.
- J. Review the HVAC Control System Sequences
 - 1. To ensure that building energy efficiency targets are met, the design engineer must prepare detailed sequences of operation that address all aspects of intended performance, including adjustable set points, non-adjustable set points, weekly schedules, alarm parameters, warnings, trends, tuning, and energy-efficient processes.
 - 2. The CxP shall carefully review these sequences, make certain they contain adequate detail, and incorporate energy-efficient process. The CxP reviews the sequences with the owner's representative, who is assigned to manage the campus BAS systems. Provide suggestions to the design team to address the optimized sequence of operations.
- K. Review Construction Documents
 - 1. The CxP shall review construction documents prepared by the design team and review the documents with the owner's representatives and document their comments and concerns. The CxP shall prepare a written list of comments and forward the list to the owner and the design team.
 - 2. The CxP shall follow up with the design team to ensure written responses to the review comments are provided.
 - 3. Objectives:
 - a. Verify consistency with the BOD and OPR
 - b. Verify that the comments from the CxP and owner submitted after the design development review have been addressed.
 - c. Review major equipment capacity information provided against general experience for similar facilities
 - d. Review sequences of operation for clarity, completeness, and energy efficiency.
 - e. Assess accessibility to valves, gauges, thermometers, dampers, control components, etc.
 - f. Spot-check above-ceiling clearances to ensure adequate space is provided for access/maintenance of all above-ceiling MEP equipment (valves, air terminal units, duct heaters, dampers, etc.).



- g. Assess adequacy for operations and maintenance of quality and location of sensors, flow-measuring stations, and so on.
 - h. Spot-check comparison of the design development review comments and the construction documents to ensure the comments have been picked up and that adequate space allocation, equipment layouts, maintainability, and coordination of systems are provided
 - i. Check for sufficient isolation valves, dampers, interlocks, and piping so that conditions can be simulated for overrides, failures, etc.
 - j. Check the documents for coordination between disciplines for requirements for system integration
- L. Update Commissioning Plan and Commissioning Specifications
 - 1. As the construction documents near completion, the CxP shall update the commissioning plan and commissioning specifications. The updated documents should be detailed and project-specific. The CxP shall develop the final pre-functional checklists and functional performance test procedures and attach them to the commissioning plan. The updated documents should be issued with the final construction documents.
- M. Facilitate Development of The Utility Management Plan (UMP)
 - 1. The CxP should work with the owner's utility manager, design team, and contractor to facilitate development of the Utility Management Plan before completion of the final design. After the project team develops the UMP, the CxP submits the plan to the owner's utility manager.
 - 2. UMP Components:
 - a. Written inventories of the operating components of utility systems including the following:
 - 1) Chilled water systems
 - 2) Heating water systems
 - 3) Domestic cold water systems
 - 4) Sanitary sewer systems
 - 5) Natural gas systems
 - 6) Fire alarm systems
 - 7) Steam systems
 - 8) Fire protection systems
 - 9) Normal power systems
 - 10) Essential power systems
 - 11) HVAC systems
 - 12) Vertical transportation systems
 - b. Written descriptions of the inspection, testing, and maintenance activities for operating components of critical utility systems
 - c. Detailed diagrams of utility distribution systems
 - d. Written procedures for responding to utility disruptions
 - e. Written procedures for shutting off malfunctioning utility systems and notification procedure for affected areas and occupants



- f. Written procedures for obtaining emergency repair services
- g. Written identification of alternative means for providing electricity, water, and fuel
- h. Written identification of alternative means of providing other critical utilities, such as vertical transport, assisted evacuation for disabled occupants, etc.

N. Attend the Pre-Bidding Conference

- 1. The CxP shall attend the pre-bidding conferences and answer questions regarding commissioning.

1.5 Construction Phase

A. The CxP shall include the following tasks during construction phase:

- 1. Conduct the commissioning conference
- 2. Develop and maintain the issues log
- 3. Review submittal data and shop drawings
- 4. Review operations and maintenance manuals
- 5. Conduct commissioning meetings
- 6. Attend selected project meetings that are needed to resolve issues and concerns and coordinate the commissioning process
- 7. Lead O&M staff construction site tours
- 8. Complete pre-functional checklists and inspections
- 9. Review HVAC control-programming code using software simulation to make certain it conforms to the design intent. The CxP shall review the programming code performance by witnessing virtual simulation before implementation and again after implementation review to ensure proper performance.
- 10. Witness equipment and system start-up and review the completed start-up documentation
- 11. Review TAB report and spot check a representative sample of airflow and water flow readings as documented in the TAB report.
- 12. Witness functional performance tests. The CxP shall exploit the system operating parameters to test the safety interlocks
- 13. Facilitate pressure testing for building envelop, HVAC duct leak test, test for positive and negative pressurized rooms
- 14. Review record drawings

1.6 Transition to Operational Sustainability

A. The CxP shall facilitate development of operating and maintenance dashboards that includes:

- 1. Building energy demands and costs
- 2. Air terminals air Handling Unit
- 3. Exhaust system
- 4. Domestic water systems
- 5. Heating water systems
- 6. Chilled water systems
- 7. Water chillers and cooling towers
- 8. Steam systems



9. Boilers
10. Normal power systems
11. Essential power systems

1.7 Facilitate Maintenance Staff Training

- A. The training program should be developed by the project construction team with support from manufacturers and vendors and should address the specific needs of the facility. A detailed program should be documented and submitted to the design team, owner, and CxP for review and approval well before the training schedule is developed. The CxP shall monitor scheduling and execution of the training process to ensure their quality is good enough for later training use. Training sessions should be recorded by professional services and stored in an electronic library for easy access.
- B. The CxP should develop testing to assess the O&M staff's knowledge. Anonymous pre-testing should be conducted before training to determine the specific training needs. Anonymous post-testing should be conducted afterward to verify the training's effectiveness and to identify additional training needs.
- C. Training Program Components
 1. A description of the general purpose of the equipment or system the training covers
 2. Start-up and shutdown
 3. Normal operation
 4. Unoccupied operation
 5. Seasonal changeover
 6. Manual operation
 7. Controls set-up and programming
 8. Troubleshooting
 9. Alarm interpretation
 10. Description of how the equipment/system interacts with other building systems and how it is included in operations dashboards
 11. Adjustments and optimizing methods for energy conservation

1.8 Prepare the Commissioning Report and Systems Manual

- A. The CxP completes the commissioning report and systems manual at the completion of the construction phase. The report shall include:
 1. An executive summary, a history of action items and deficiencies noted and how they are resolved
 2. System performance tests and evaluations
 3. A summary of the design review and submittal processes
 4. A summary of the O&M documentations and training process
 5. Commissioning documentation from the process that includes:
 - a. Meeting minutes
 - b. Completed documents such as start-up documents, completed pre-functional checklists, functional performance test results, training data, etc.



- B. The CxP compiles the systems manual, which focuses on operating systems manual that includes:
 - 1. Final version of the OPR and BOD
 - 2. System single-line drawings
 - 3. As-built sequences of operation
 - 4. Control shop drawings
 - 5. Original Control set points
 - 6. Operating instructions for integrated systems
 - 7. Recommended retesting schedule and blank test forms
 - 8. Sensor and actuator recalibration schedules
 - C. The CxP shall facilitate the development of the maintenance budget and staffing requirements using the APPA benchmarking tools.
- 1.9 Facilitate Fire and Smoke Damper Inspections and Testing
- A. The CxP shall with the contractor complete the initial damper inspection and testing at the completion of the construction phase, immediately before the building is occupied. Provide a written report listing each damper number, damper location, and date of inspection, damper inspection results, and associated corrective work, if required. The CxP shall forward the final approved copy of the report to the owner. The damper inspection and testing shall include:
 - 1. Verify that the record drawings accurately indicate the location of all fire and smoke dampers and that the dampers are properly labeled.
 - 2. Locate all fire and smoke dampers. Verify that the dampers are properly tagged.
 - 3. Remove and reset fusible links on fire dampers to verify each damper fully closes. Replace fusible links as required.
 - 4. Lubricate all moving parts on each damper
 - 5. Clear each damper of any obstruction impeding the dampers' normal operation.
 - 6. Manually activate each smoke damper and combination fire-and smoke damper actuator to verify proper operation.
- 1.10 Facilitate Completion of the Statement of Conditions (SOC): The CxP shall work with the owner and design team to facilitate completion of the SOC for the building.
- 1.11 Facilitate Development and Implementation of the Building Maintenance Program
- A. The CxP shall work with the owner's representative, design team, and contractor to develop and implement a building maintenance program for the new facility. The CxP shall implement and populate the owner's computerized maintenance management (CMMS) system database. The scope of the CxP 's involvement in the development and implementation of the maintenance management program should include:
 - 1. Ensure that all equipment is numbered and labeled in a manner consistent with facility standards.
 - 2. Ensure that room numbers indicated on the construction drawings are consistent with facility standards and actual room numbers.



3. Ensure the owner receives an electronic archive of all information required to operate and maintain the facility. If possible, the design team and contractor should insert the electronic archive into a three dimensional electronic model of the building (BIM). The archive should include:
 - a. Design calculations
 - b. Record drawings
 - c. Project manual
 - d. Submittals
 - e. Shop drawings
 - f. Coordination drawings
 - g. Factory test reports
 - h. Pre-functional checklists
 - i. Equipment start-up reports
 - j. Tab reports
 - k. Functional Performance test results
 - l. Other test results
 - m. Installation requirements
 - n. Operations and maintenance manuals
 - o. Spare parts inventory
 - p. Recommended schedule and frequency for maintenance procedures
 - q. Parts lists
 - r. Warranties and bonds
 - s. Service contracts
 - t. Service provider contact information
 4. Ensure each item of equipment and its associated maintenance and operating information is identified in the CMMS.
 5. Ensure the CMMS automatically generates work orders for recommended maintenance procedures at the recommended frequency
 6. Ensure a complete service history for each item of equipment is maintained in the CMMS
 7. Ensure the CMMS provides for regular calibration of temperature, pressure, and other sensors critical to efficient system performance.
- 1.12 Post-occupancy and Warranty Phase: CxP shall review trend data for HVAC systems. Measure and verify actual energy performance and compare with APPA and EPA benchmarking tools to establish a baseline data for the facility. These figures should be compared with the project energy efficiency goals. If the actual energy consumption and costs exceed the predicted levels, the CxP shall work with the facility M & O team, design team, and contractor to identify the cause of the disparity and implement corrective action.
- 1.13 Post- Occupancy Performance Tests: The CxP must coordinate required seasonal or deferred testing and follow up noted deficiencies until corrections are made. A report documenting this testing process should be included in the commissioning record.



- 1.14 Participate in the End of Warranty Review: The CxP shall participate with the owner, contractor, and the design team in a comprehensive review of the project near the end of the warranty phase. The review indicates outstanding construction deficiencies and deficiencies discovered by the operation and maintenance staff. The CxP shall assist other members of the project team with correction of deficiencies and reports outcomes to the facility management team.
- 1.15 Benchmark Energy Performance: After the building has been in service for one year, the owner shall benchmark the actual energy efficiency of the building with CxP's assistance. The benchmarking process should be based on actual energy and water consumption and costs as compared with the EPA and APPA defined performance target.

END OF SECTION



SECTION 23 09 23

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 systems then the existing building DDC control system may be re-used.
- 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 browsers like Google or Internet Explorer over Internet or Intranet or dedicated client computer. The BAS shall use twisted pair copper conductors or Ethernet cabling 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 communication.
- 1.3 Approved Manufacturers: Automated Logic Controls, Siemens Building Automation and Johnson Controls.
- 1.4 Design Documents: Provide all physical input/output point summaries on drawings. Provide sequence of operation on drawings referring to all input/output points in summary list. During the design process, submit 80% complete controls drawings at the design development submittal. Drawings shall include all sequences and the input/output points list. Provide flow diagram for hydronic and air systems on drawings.
- 1.5 Interoperability: If the project involves a GSU building which has an existing Siemens 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 standalone capabilities. The BAS contractor shall contact Siemens Building Technologies in Atlanta to get necessary information or co-ordination. The same should occur if Siemens is the lowest bidder and needs information from a DDC system manufactured by a company other than Siemens. No gateways or protocol converters shall be allowed.



1.6 System Components:

- A. Major HVAC equipment like AHUs, Chillers, Boilers, Cooling Towers and Pumps 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 loses memory, the system shall automatically reload the DDC controller from the database server via the network.
- B. VAV, FCU, PIU, Fume hood monitors may use application specific controllers (ASC) programmed controllers.
- C. Application specific controllers (ASC) can be used to provide operating equipment information over RS-485 serial communication or Ethernet cabling for VFDs, Roof top units, packaged AHUs, chillers, boilers.
- 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 76°F unless otherwise specified for special range.
- E. All immersion pipe sensors and duct sensors shall be RTD, PT100 or PT1000 type. No thermistor type sensor shall be 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 non-stall electronic types. Only under special circumstances shall pneumatic actuators 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 is designed to incorporate airside economizer then provide return air temperature sensor and relative humidity sensor. The system shall use enthalpy algorithm to measure return air enthalpy and compare with outside air enthalpy 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 critical or high containment 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.
- 1.7 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, or use BTU meter.
 - 1.8 Graphic standard: The control vendor shall provide graphics as close as possible to existing building graphics currently used. It is recommended that control vendor review the existing graphics prior to develop new graphics for any new projects.
 - 1.9 If renovation project involves in existing building then the existing floor graphics shall be modified to reflect all changes. Each floor shall have its own floor graphics converted from existing building AutoCAD file. All AutoCAD files can be provided by GSU project manager for use by the control vendor.
 - 1.10 All zones shall be colored differently to identify the zone boundary limits. Use floor plans to identify zones. Show terminal box locations and sensor locations for each zone.
 - 1.11 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.
 - 1.12 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.



1.13 All control logic shall request same as graphic links; zone temperature sensor shall request heat or cooling from corresponding terminal unit, terminal unit shall request its source from the associated AHU, AHU shall request its source from the chilled water pump, etc. Building load shall request chiller plant to produce chilled water, if applicable.

1.14 Work by Others:

- A. Mechanical contractor shall install all wells, valves, taps, dampers, flow stations, etc. furnished by BAS manufacturer.
- B. Electrical Contractor provides:
 - 1. 120V power to all BAS and/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.

1.15 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.

1.16 Submittals:

- A. Project specifications shall include the following:
 - 1. Submittals shall include the following at a minimum:
 - a. Valve and damper schedules.
 - b. Equipment data cut sheets.
 - c. System schematics, including:
 - 1) Sequence of operations.
 - 2) Point names.
 - 3) Point addresses.
 - 4) Interface wiring diagrams.
 - 5) Panel layouts.
 - 6) System riser diagrams.
 - 7) Auto-CAD compatible as-built drawings.
 - 2. Upon project completion, submit operation and maintenance manuals, consisting of the following:



- a. Index sheet, listing contents in alphabetical order.
- b. Manufacturer's equipment parts list of all functional components of the system, Auto-CAD flash drive of system schematics, including wiring diagrams.
- c. Description of sequence of operations.
- d. As-Built interconnection wiring diagrams.
- e. Operator's Manual.
- f. Trunk cable schematic showing remote electronic panel locations, and all trunk data.
- g. List of connected data points, including panels to which they are connected and input device (ionization detector, thermostat, etc.).
- h. Conduit routing diagrams.

1.17 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.

1.18 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



1.19 Sequence of Operation: Job specific - per job requirements.

1.20 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 in to 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

1.21 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.

1.22 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 23 09 43
LABORATORY AIR FLOW CONTROL SYSTEM

- 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.
- 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 general laboratory supply air valves and general exhaust valves may use blade type damper mechanisms and Pitot tube type air flow sensors, except for critical or high containment laboratories.
- 1.5 All critical or high containment laboratories shall have a standalone closed loop controller that maintains a CFM offset between supply and exhaust airflows to maintain negative pressures.
- 1.6 All fume hood monitors shall use a digital type display maintaining fume hood face velocity. Monitors shall have local alarm capabilities for face velocities and sash override alarms. The fume hood monitors shall be capable of integrating with BAS using serial interface communication.
- 1.7 Ventilation Systems:
 - A. The use of direct drive fans is encouraged for all ventilation systems.
 - B. Fume hood exhaust fans are preferred to be direct driven mixed-flow induced dilution type similar to Strobic Air Corp. "Tri-Stack".
- 1.8 Exhaust duct shall be Type 316 Stainless Steel.

END OF SECTION



SECTION 23 21 00
PUMPS

- 1.1 Base mounted pumps are preferred.
- 1.2 Use of in-line pumps is discouraged.

END OF SECTION



SECTION 23 21 15
UNDERGROUND HYDRONIC PIPING

- 1.1 Use manufactured pre-insulated pipe.

END OF SECTION



SECTION 23 31 00
DUCTWORK AND AIR DISTRIBUTION

- 1.1 All ductwork shall comply with the latest SMACNA Standards.
- 1.2 Shop stickers shall be located on the outside of the ductwork.
- 1.3 Thermal Insulation: Insulation on ductwork in mechanical rooms and at every other location subject to damage shall be 4 lb./cu. ft. density semi-rigid fiberglass board type. Insulation shall be secured to the ductwork using adhesive and pins and washers. A canvas cover shall be provided embedded in mastic.
- 1.4 All new ductwork shall be sealed.
- 1.5 Variable Air Volume units, Powered Induction Units and other terminal HVAC equipment shall have 36 inches minimum side clearance for maintenance access. Insulation located inside VAV units, PIUs and similar terminal units shall be closed
- 1.6 Provide access panels for fire damper, smoke damper, and combination fire/smoke damper maintenance. Panels shall comply with SMACNA Standards.
- 1.7 Flexible duct runs no longer than seven (7) feet are allowed.
- 1.8 Provide access to sheet metal accessories, air dampers, splitter dampers, etc. All access panels are preferred to be 24-inch square.
- 1.9 Provide balancing dampers with continuous shaft on all branch lines with memory stop.
- 1.10 Ductwork pressure testing shall be performed on all laboratory exhaust duct, medium pressure duct, toilet exhaust duct, and dedicated outside air systems.
- 1.11 Fiberglass duct board is not allowed.
- 1.12 Laboratory Exhaust duct shall be Type 316 Stainless Steel.

END OF SECTION



SECTION 23 52 00
HEAT GENERATION

- 1.1 Condensing heating hot water boilers are preferred.
- 1.2 Cleaver Brooks fire tube boilers for steam is preferable.
- 1.3 Provide emergency shutdown button switch for each boiler. Switch shall be maintained and tested, mushroom type at mechanical room entrance.
- 1.4 Boilers that serve Vivarium space heating, cage washer and steam for autoclaves shall be on emergency power.

END OF SECTION



SECTION 23 64 00
CHILLERS

- 1.1 Magnetic bearing centrifugal chillers are preferable.
- 1.2 Screw type compressors are preferred for air cooled chillers.

END OF SECTION



SECTION 23 65 00
COOLING TOWERS

- 1.1 Stainless steel cold water basins are preferred.

END OF SECTION



SECTION 23 74 00
AIR HANDLING UNITS (INCLUDE FCUs, RTUs, Etc.)

- 1.1 Evaporator coils/condensate drains in ceilings shall have emergency drip pans and/or 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). If a drip pan is used, all service access shall be maintained.
- 1.2 All condensate drain pans shall be coated with rust preventative paint or be stainless steel, and shall be sloped properly to drain to prevent the accumulation of condensate in the drain pan.
- 1.3 Coil casings shall be stainless steel construction.
- 1.4 Cooling coils shall be provided with maximum of 12 fins per inch.
- 1.5 Face velocity for cooling coils shall not be more than 450 fpm.
- 1.6 Each cooling coil shall have a drain pan.
- 1.7 Intermediate drain pans shall be installed on multiple coil sections and each intermediate drain pan shall be individually piped to lower drain pan or drain.
- 1.8 Air Handling Units shall be double wall construction.
- 1.9 Do not locate any air handler above the ceiling without prior approval.
- 1.10 For energy recovery equipment, locate all maintenance parts (belts, motors, bearings etc.) outside of contaminated air stream, as applicable.
- 1.11 All Air Handling Units with chilled water coils shall have minimal preheat coil for freeze protection, if required based on outside air flow.
- 1.12 Air filters shall be provided for all AHUs, PIUs, FCUs, RTUs, energy recovery units, etc. Air filters shall meet code required filtration requirements.
- 1.13 For VRF systems, "Pro-Press" type fittings or flexible copper piping shall not be used. Branch controller connections shall be soldered joints. Flared nuts are unacceptable. VRF three-pipe systems shall be used for comfort cooling and two-pipe systems can be used for data closets.

END OF SECTION



SECTION 23 90 00
FACILITY FUEL SYSTEMS

- 1.1 Generators shall be natural gas if possible. Use of diesel generators must be approved by the GSU Project Manager.

END OF SECTION



DIVISION 26 –ELECTRICAL

1.1 GENERAL

- A. Provide 10-20% capacity in the main service for future growth.
- B. Provide ground wire in each circuit.
- C. Minimum receptacle quantities shall be determined the Code and in consultation with the GSU Project Manager.
- D. Within individual buildings, match existing manufacturer for electrical distribution equipment.
- E. Concrete encase all underground secondary service circuits.
- F. All ground conductor terminations at ground rods, ground plates and structural steel shall be cadweld type connections.
- G. Provide ¾ inch gray painted plywood backboard with an angle aluminum frame behind all surface mounted panels and equipment.
- H. Concrete housekeeping pads, 4 inches high with mitered edges, are required below all freestanding equipment and where exposed conduit penetrates the floor below panels.
- I. Provide laminated plastic nameplates with 3/16 inch white letters for all electrical distribution equipment and panels and circuit breakers on the main switchgear or switchboard. Nameplates shall be riveted to enclosure. Include fed from information and voltage.
- J. Paint junction box covers (unless exposed in finished spaces) as follows:
 - 1. Fire Alarm Systems: Red
 - 2. Security Systems: Yellow
 - 3. Telephone Systems: White
 - 4. Data Systems: Blue
 - 5. Television Systems: Green
 - 6. Sound Systems: Brown
 - 7. Emergency Power Systems: Orange
 - 8. Normal Power Systems: Unpainted
- K. Outside of junction box covers shall be identified by printing the circuit number for the respective system with a black permanent marker in 3/4 inch high letters (handwritten is acceptable).

END OF SECTION



**SECTION 26 20 00
Low-Voltage Electrical Distribution**

1.1 Main Service Switchboard/Switchgear:

- A. Tin plated copper bussing.
- B. A digital demand power meter to monitor power consumption is required on all new switchboards. (interfaced with BAS)
- C. Provide a power study including short circuit, coordination study and arc flash risk assessment.
- D. Provide fully rated circuit breakers.

1.2 Distribution and Branch Circuit Panelboards

- A. All circuit breakers are required to have bolted bus connections. Panelboards tin plated copper bussing.
- B. Provide door-in-door or hinged type panelboard front covers with steel frame for circuit breaker index inside door.
- C. Panelboard boxes with concentric knockouts pre-punched by the manufacturer will not be acceptable.
- D. Transient voltage surge suppression (TVSS) units are encouraged to be used on all receptacle power panelboards and Service Entrance Equipment, UL 1449 listed.

1.3 Disconnect Switches:

- A. Provide lockable heavy duty type safety switches.

1.4 Dry Type Transformers:

- A. Copper windings
- B. K-13 rated dry type transformers with 200% neutral terminals.
- C. Constructed for maximum 115 C rise in conductor temperature under full load.
- D. Provide Bolted rubber-in-shear vibration isolators under each transformer corner for sound attenuation.



1.5 Conduit and Raceway:

- A. Galvanized rigid steel conduit or intermediate metallic conduit (IMC) shall be used in all locations below finished floor or grade and where exposed to weather except where schedule 40 PVC conduit is specifically allowed by the Institution. Where schedule 40 PVC conduit is allowed by the Institution, galvanized rigid steel shall be used for the transition through the slab.
- B. All metal conduit below grade shall be painted with two coats of bituminous coating to least 6 inches above penetration. A marker ribbon is required in fill dirt 6 inches above buried conduit. Locator cables shall be provided in all underground PVC conduits containing fiber optics cable.
- C. Flexible metal conduit (Type MC) is permitted for light fixture connections from junction boxes above accessible ceilings, maximum 6 ft in length, and in retrofit applications with limited wall or ceiling access.
- D. Liquid-tight flexible metal conduit shall be used at all motor connections.
- E. Electrical metallic tubing shall be used in all interior dry locations except where flexible metal conduit and IMC is required.
- F. A galvanized rigid steel or IMC transition is required (long radius elbow).
- G. In retrofit applications where concealed raceway is not possible, provide metal surface mounted raceway.
- H. Galvanized rigid steel conduit fittings shall be malleable iron threaded. EMT fittings shall be malleable iron or steel split ring compression type. The use of indenter or screw fittings shall be avoided.
- I. Minimum $\frac{3}{4}$ " conduit for power
- J. Minimum 1" conduit for telecom
- K. Provide A 200 lb. rated polyethylene pull cord in all empty conduits.
- L. Conduits must be homerun to the panel serving the circuit. The use of wire troughs and cans shall not be permitted.

1.6 Outlets and Boxes:

- A. 4 inch square x 1-1/2 inch deep outlet boxes in concealed wall outlet locations with a plaster ring for service and type of outlet.



- B. Outlet boxes in wet locations shall be cast ferroalloy type with threaded hubs and gasketed covers.
- C. Centerline of wall outlet boxes at the following elevations:
 - 1. Receptacles, computer, telephone and television outlets - 18 inches above floor.
 - 2. Switches and manual fire alarm pull stations - 42 inches above floor.

1.7 Wiring Devices and Cover Plates:

- A. Switches and receptacles shall be 20 amp rated, specification grade devices similar to Arrow-Hart 1221 series for switches and Arrow-Hart 5362 series for receptacles.
- B. Color of devices:
 - 1. Grey devices with standard size stainless steel cover plates. (All Campuses).
- C. Receptacle mounting orientation:
 - 1. Duplex outlets shall be installed with ground poles on top (All Campuses).
- D. Device plates shall be brushed stainless steel. Jumbo size covers are preferred on masonry walls.
- E. Weather-proof cover plates shall be 'in-use' rated.

1.8 Conductors and Cables:

- A. Less than 100A copper conductors only
- B. Over 100A, Aluminum conductors are permitted
- C. Connections to vibrating equipment shall utilize copper conductors
- D. Minimum conductor size shall be #12 AWG.

END OF SECTION



**SECTION 26 40 00
ELECTRICAL PROTECTION**

1.1 Lightning Protection Systems:

- A. All lightning protections systems shall be designed in accordance with NFPA 780 and shall be UL Master Labeled.

1.2 Surge protection devices

- A. Provide surge protection on main service equipment, distribution panelboards, and branch circuit panelboards.

END OF SECTION



**SECTION 26 50 00
LIGHTING**

1.1 Lighting:

- A. Source – generally provide LED, color temperature 4000K (interior and exterior).
- B. 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.
- C. Control of any automatic lighting control systems shall be included in the BAS.
- D. Preferred interior lighting fixture types as follows:

2 x 4 LED 4000k Fixture: Metalux Cruze ST - Provide version with ribbed frosted acrylic lens shielding nominal 3" recess depth.

2 x 2 LED 4000k Fixture: Metalux Cruze ST - Provide version with ribbed frosted acrylic lens shielding nominal 3" recess depth.

Exit Lights: Alkco RGLO-LED, Chloride STDLX/STELX, Emergi-Lite LX/LXN
Hubbell X3DL/X3EL, Light Alarms SPLED, Light Guard SLELX,
Lithonia LRP/LRP EL N Prescolite LEP, Sure-Lites ELX

- E. Occupancy sensors are desired in offices, classrooms, meeting rooms and lecture halls. Do not use occupancy sensors in Laboratories.
- F. Classroom lighting control: Lighting along the Instructor's wall shall be switched separately from the rest of the classroom.
- G. Items of electrical equipment containing integral DDC-based control programming shall be specified to be compatible with the campus-wide Building Automation System (BAS). This equipment shall include, but not be limited to lighting control systems.
- H. Exterior lighting shall be as follows:
 - 1. Pole Lighting:
 - a. Single Head Pole Mounted LED: Spaulding CL-1-X-90L-1-4K-2-105
 - b. Dual Head Pole Mounted LED: Spaulding CL-1-X-90L-1-4K-2-105
 - 2. Walkway Lighting:
 - a. Walkway LED Lighting Fixture: Sternberg Solana #PT=SL760-FFG-112L-45-T5-F-MDH03-UB.
 - b. LED Bollard Fixture: Sternberg Solana #PT=SL360-28L-4500-T5-MDL03-UB.

END OF SECTION



Georgia State University
Architectural and Engineering Design Standards

DIVISION 28 00 00
Electronic Safety and Security

SECTION 28 10 00

ELECTRONIC ACCESS CONTROL

Reference Exhibit E - Electronic Door Access Installation Guide



SECTION 28 31 00

FIRE DETECTION and ALARM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the Contract Documents, including the General and Supplementary General Condition and Division 1 - General Requirements shall apply to the work of this section.
- B. At the time of bid the contractor shall list all exceptions taken to these Specifications, all variances from these specifications and all substitutions of operating capabilities or equipment called for in these Specifications and forward said list to the Engineer. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. Final determination of compliance with this Specification shall rest with the Engineer, who, at his discretion, may require proof of performance.

1.2 RELATED WORK

Division 26Basic Materials and Methods

Division 21:Sprinklers

Division 23:HVAC Systems

Division 8:Door Hardware

1.3 RESPONSIBILITIES

- A. This section of the specification includes the provision and installation of the Fire Alarm/Life Safety System. The Electrical Contractor shall include in his bid all moneys required to contract the services and equipment of a Fire Alarm/Life Safety System Vendor. The Electrical Contractor is responsible for providing to the Fire Alarm/Life Safety System Vendor drawings and specifications for bidding and construction.
- B. The Electrical Contractor will provide all materials and labor to pipe, pull wire, and install all mounting and equipment enclosures as specified in Part 3 - Execution of this specification. This installation will reflect the Fire Alarm/Life Safety System Vendor's shop drawing as much as practically possible. The Electrical Contractor shall provide the Fire Alarm/Life Safety System Vendor with an accurate point to point plan indicating conduit and cable routing, pipe fill, wire identification, and junction points.
- C. The Bidding Installing Contractors, Design Professional and the Owner shall attend a pre-bid meeting to discuss in questions, comments, exceptions, and/ or reservations to the drawings and specifications prior to bid. By not identifying any differences prior to



bid, the contractor is not entitled to any additional money. The pre-bid meeting shall be coordinated ten (10) business days in advance prior to meeting date.

- D. The Electrical Contractor is responsible for contracting and scheduling the work of the Fire Alarm Vendor. The Electrical Contractor shall notify the GSU project manager of the Fire Alarm Vendor's scheduled date(s) on-site, not less than two (2) weeks in advance.
- E. The Electrical Contractor shall provide the Fire Alarm Vendor, a motorized aerial work platform and ladder for use during the entire period of the Fire Alarm Vendor's installation. The platform shall be capable of raising the Fire Alarm Vendor to any work elevation inside the building.
- F. All conduit, boxes (unless otherwise indicated), fittings, couplings, connectors, straps, supports, pull-lines, bushings, etc. shall be provided by the Electrical Contractor.
- G. The Electrical Contractor shall provide all line voltage (120 V. max.) and low-voltage (up to 50 VAC/VDC) circuiting in separate conduit. Low-voltage circuiting shall be run exposed using NEC-FPL rated cable per NEC Article 760, unless otherwise noted by local jurisdictional authorities. All exposed cable below the bottom bar joist or other roof structure protruding lower, or other locations where the cable may become exposed and/or damaged, must be within a steel conduit by Electrical Contractor.
- H. System operation, testing. Turn-over, warranty, compliance, and after-market service shall be provided by the Fire Alarm Vendor.
- I. A written report shall be prepared by the Fire Alarm Vendor and submitted to the GSU representative at the completion of the project, not less than one (1) week prior to the opening date. This report shall outline the walk-test results and identify any items not completed and fully operable. Any item that is identified in this report must be corrected and the system must be fully operable prior to the date of the final building Certificate of Occupancy Inspection.
- J. Transmission to Remote Alarm Receiving Station:
 - 1. Configure the Fire Alarm system to send separate signals for each addressable device.
 - 2. Provide direct communication to the Central Station Alarm Monitoring without passing signals through the Burglar Alarm equipment.
 - 3. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
 - 4. The installing fire alarm contractor shall provide the fire alarm zone/point list to the Central Station.

PART 2 - GSU DOWNTOWN CAMPUS PROJECTS ONLY — DELETE FOR GSU PERIMETER BUILDINGS

- 1. The installing fire alarm contractor shall test thru 100% of the fire alarm signals to the GSU Downtown Central Station. The installing contractor shall confirm that



the Central Station has received all signals (100%) and ensure that the fire alarm system is monitored by the Central Station.

PART 3 - GSU PERIMETER CAMPUS PROJECTS ONLY — DELETE FOR DOWNTOWN GSU BUILDINGS

1. The installing fire alarm contractor shall test thru 100% of the fire alarm signals to the Clarkston Campus Central Station and GSU's Downtown Central Station. The installing contractor shall confirm that both Central Stations has received all signals (100%) and ensure that the fire alarm system is monitored by both Central Stations.
- B. Fire alarm system shall be fully operational and tested prior to installation of product racking within the building.
- C. Contractor is responsible to remove any and all existing fire alarm components and related wiring, conduits, panels, devices, etc.

3.2 SCOPE

GSU DOWNTOWN CAMPUS PROJECTS ONLY — DELETE FOR GSU PERIMETER BUILDINGS

- A. All equipment described herein and provided and installed under this section shall be the standard products of one manufacturer. Approved system models shall include Simplex Panels only, and in compliance with these specifications will be considered acceptable.

GSU PERIMETER CAMPUS PROJECTS ONLY — DELETE FOR GSU DOWNTOWN BUILDINGS

- B. All equipment described herein and provided and installed under this section shall be the standard products of one manufacturer. Approved system models shall include Simplex Panels only, and in compliance with these specifications will be considered acceptable.
- C. Any reference to device, component, unit, module, or system shall be understood to mean the Fire Alarm/Life Safety System, or any associated manufactured product thereof.
- D. The work covered by this section of the specification shall include all labor, equipment, materials and services to furnish and install a complete fire alarm system of the zoned, non-coded general alarm type. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer. The system shall consist of, but not be limited to, the following:
 1. Fire alarm control panel.
 2. Remote Annunciator.
 3. Addressable manual fire alarm pull stations.
 4. Addressable analog area smoke detectors.



5. Addressable analog duct smoke detectors.
6. Automatic release of time delay equipped doors.
7. Sprinkler water-flow alarm switches.
8. Audible notification appliances; horns.
9. Visual notification appliances; strobes.
10. Mass Notification speakers.
11. Mass Notification strobes.
12. Central station alarm connection control.
13. Air handling systems shutdown control on all sales floor HVAC units.
14. Dry valve sprinkler system supervision and control.
15. Master Box and all necessary connections.
16. Sprinkler supervisory switches and tamper switch supervision.
17. Battery standby.
18. Ansul Hood supervision.
19. Fire pump supervision where required.
20. Fan shutdown control for the ceiling fans on the sales floor and tire installation.

3.3 QUALITY ASSURANCE

A. Manufacturer

1. The system and components shall be supplied by one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten (10) years, and who shall be able to refer to similar installations rendering satisfactory service.
2. The equipment described in this section represents the function and type of some of the materials required and herein specified. The equipment indicated in this section does not intend to be a complete list of all components required for an operational and approved system but only as guidelines from which the system should be designed around. Additional equipment not herein specifically indicated but are a necessary part of an operational and approved system shall be provided as required.

B. Contractor

1. The installing contractor shall be a licensed contractor in the State of Georgia.
2. The fire alarm shop drawings shall be designed by an individual who is at least a NICET level III in Fire Alarm Systems.
3. The installation shall be supervised by an individual who is at least a NICET level II in Fire Alarm Systems.

C. Submittals

1. Contractor shall pay application fees and obtain full approval of submittals in writing from the Georgia State Fire Marshal's Offices prior to submittal to Owner's Representative (Telgian Corporation) for review.
2. Submit fire alarm submittals to the Owner's Representative (Telgian Corporation) within 30 calendar days after award of Contract
3. Contactor's submittals shall be issued electronically. Plans shall be in PDF or DWF format and to scale. Hard copy submittals will not be reviewed per the owner.
4. The shop drawings shall provide the following as a minimum:



- a. A complete fire alarm one line riser diagram indicating components, devices, conductors, conductor sizes, and end-of-line resistors.
 - b. Scaled floor plans showing all device locations, device legend, an accurate point to point plan indicating conduit and cable routing, pipe fill, wire identification, and junction points.
 - c. Fire alarm site plans shall be at not less than 1" = 50' scale
 - d. The Fire Alarm Vendor shall provide line voltage drop calculations that shall demonstrate that the voltage supplied at all indicating appliances is above the UL specified minimum for the indicating appliances employed. These calculations shall assume operation on standby batteries after the required standby period. Therefore, a battery output of 20.4 VDC shall be used in these calculations. The Fire Alarm Vendor shall provide sufficient quantities of addressable indicating circuit modules and 24 VDC power supplies, in the proper locations, to ensure that the UL specified minimum voltage is present at all indicating appliances.
 - e. Notification Appliance Circuit load calculations.
 - f. Standby battery power calculations.
 - g. Sequence of Operation with description of each major system function.
 - h. Point enunciation table describing all initiating device descriptions as they will appear on the alpha-numeric display.
 - i. Equipment specification sheets for all components to be utilized.
 - j. Shop drawings and equipment submittals must reflect the above criteria as a minimum. Incomplete submissions will be rejected.
- D. Equipment Handling
- 1. The Fire Alarm Vendor shall deliver each piece of equipment in durable shipping cartons of manufacturer's label. Damaged cartons shall not be accepted. Maintain cartons throughout contractor transport, storage, and handling undamaged and free of dirt, paint, chemicals, water or moisture.
- E. Applicable Installation Codes and Standards
- 1. All equipment shall be U.L. listed for its intended use.
 - 2. The National Fire Alarm Code NFPA 72, latest edition.
 - 3. The National Electric Code NFPA 70, latest edition.
 - 4. The locally enforced State of Georgia Building and Fire Codes. Current Editions.
 - 5. All other local codes, ordinances, and authorities having jurisdiction.
- F. Standards

The system and all components shall be listed by Underwriters Laboratories, Inc. for use in Fire Protective Signaling Systems under the following standards as applicable:

UL 864/UOJZ, APOU Control Units for Fire Protective Signaling Systems.
UL 268 Smoke Detectors for Fire Protective Signaling Systems.
UL UL268A Smoke Detectors for Duct Applications.
UL 228 Door Closures-Holders for Fire Protective Signaling Systems.
UL 464 Audible Signaling Appliances.



- UL 1971 Visual Signaling Appliances.
- UL 38 Manually Actuated Signaling Boxes.
- UL 346 Water flow Indicators for Fire Protective Signaling Systems.
- UL 1481 Power supplies for Fire Protective Signaling Systems.
- UL 2572 Mass Notification Systems

G. Related Documents

1. Electrical Contractor shall secure permits and approvals prior to installation.
2. Prior to commencement and after completion of work notify Authorities Having Jurisdiction.
3. Submit letter of approval for installation before requesting acceptance of system.

H. Related Work

1. The Electrical Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:
 - a. Sprinkler water-flow and supervisory switches and high/low air supervisory switches shall be furnished and installed by the Fire Protection contractor. The Electrical Contractor is responsible for piping to an accessible junction box, pull wire and provide a flexible raceway to the final termination at the device. Module and sprinkler system monitoring device terminations by Electrical Contractor.
 - b. Duct smoke detectors shall be furnished by the Fire Alarm Vendor. The electrical contractor shall be responsible for all wiring to the detector and from Fire Alarm System monitor module, dry contacts for global shutdown (i.e.: addressable control module.) to respective HVAC unit fan motor starter control circuit terminations. The Duct Detector housing and sampling tube shall be installed by the Mechanical Contractor.
 - c. Air handling and smoke exhaust system fan control circuits and status contacts to be furnished by the HVAC control equipment.
 - d. Elevator recall control circuits to be provided by the elevator control equipment.
 - e. Emergency generator supervision contacts to be provided by the emergency generator control equipment.
 - f. Fire pump supervision contact to be provided by the fire pump control equipment.
 - g. Time delay door control contacts to be provided by door hardware control equipment. Fire alarm contractor to coordinate final connection with door hardware and electrical contractor. Final connection of the relay shall be by the electrical contractor.
 - h. Conduit: Division 26.
 - i. Wire and Cables: Division 26.
 - j. Outlet and Junction Boxes: Division 26.
 - k. Grounding: Division 26.



- I. Warranty
 1. The Fire Alarm/Life Safety System Vendor/Manufacturer shall guarantee the system equipment for a period of one (1) year from date of final acceptance of the system.
 2. The Electrical Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.
 3. Upon completion of the installation of fire alarm system equipment, the electrical contractor shall provide to the architect a signed written statement, substantially in form as follows: "The undersigned, having engaged as the Electrical Contractor on the [Name of Project] confirms that the fire alarm system equipment was installed in accordance with the wiring diagrams, instructions and directions provided to us by the Fire Alarm System Vendor, per NFPA 72, 2016 Edition Section 7.5.2.

3.4 SYSTEM OPERATION

- A. GENERAL
 1. The fire detection and alarm system shall detect all changes in status of monitored points and shall initiate appropriate actions to alert and/or evacuate occupants, provide event annunciation and actuate auxiliary controls as specified herein.
 2. The system shall accept, process and evaluate the following types of signals:
 - a. Automatic fire detectors.
 - b. Manual alarm pull stations.
 - c. Sprinkler water-flow switches.
 - d. Sprinkler tamper switches.
 - e. Other supervisory type inputs.
 - f. Control relay response confirmations.
 - g. Detector sensitivity data.
 - h. Mass notification system inputs.
 3. Analog type smoke detectors shall have their sensitivity continuously monitored. The control equipment shall evaluate the sensitivity data for determination of sensitivity change and shall automatically provide environmental compensation to maintain constant detector sensitivity. It shall be possible to automatically or manually adjust analog detection sensitivity.
 4. Walk test mode shall test initiating devices and circuits, and indicating devices and circuits from the field without returning to the panel to reset the system. Upon activation of an initiating device, the associated visual and audible output shall operate for approximately four seconds. Inducing a trouble onto the indicating device or circuit shall activate and pulse the circuit at a one second on/off rate until the trouble is cleared. An LED for alarm, and an LED for trouble shall flash upon completion of each circuit test.
 5. When an alarm condition is detected on an initiating device circuit which has been programmed for alarm verification, the system shall automatically enter the alarm verification mode. If the alarm condition is still present after a pre-set, field adjustable time period the system will automatically become enter the alarm mode.



6. Each Fire Alarm Control Panel (FACP) shall communicate with field devices over one or more Style 4 analog-addressable signaling line circuits. These circuits shall have the following characteristics;
 - a. Circuit fault monitoring, including:
 - 1) Signaling line circuit open condition.
 - 2) Signaling line circuit short condition.
 - 3) Excessive electrical "noise" on the signaling line circuit.
 - 4) Ability to identify the location of short and open circuit conditions.
 - 5) Detector or device missing condition.
 - 6) Improper device type at a specific address.
 - 7) Un-configured device at an address.
 - 8) Multiple devices at the same address.
 - b. Provide a single point address polling function that shall cause repeated polling of a selected device for system troubleshooting. Single device polling of a smoke detector shall cause the detector's LED to illuminate steady allowing for ease of locating the detector or detectors when more than one device is mistakenly programmed at the same address.
 - c. Provide a circuit wiring distance of up to 1 mile.
 - d. Support line fault isolator modules installed in a manner that shall limit performance degradation in the event of a short on the signaling line circuit. The section of the loop around the short shall be isolated, allowing the balance of the circuit to operate. A loop test function shall be provided to locate open circuits.
7. Sub-circuits from addressable input/output modules, used to interface input/output devices (i.e. bells, conventional fire detectors, tampers, etc.) shall be supervised. Initiating circuits shall be wired for Style B operation and indicating circuits wired for Style Y operation. Supervision shall include open circuit, short circuit and ground fault. Modules requiring external power for operation of two-wire conventional detector sub-circuits and initiating device circuits shall supervise the presence of external power. Equipment requiring external supervisory relays shall not be acceptable.
8. The system shall provide summary printouts, initiated by operator command, that include as a minimum the following information;
 - a. Analog values of all points including instantaneous value and long term average value.
 - b. Points isolated.
 - c. Points tested/failed test.
 - d. Points out of sensitivity compensation.
 - e. Event log contents.
9. Each FACP shall be on site programmed. The programming software shall provide the following automated reports for owner review;
 - a. Project history (changes made to the system, with date stamp).
 - b. List of authorized system programmers.
 - c. Full system configuration data.
10. The system shall provide point isolation by single point or group of points. The system shall ignore signals from input devices when isolated. The system shall annunciate and remain in a trouble state while any device is isolated.



11. The system shall provide identification of point type, location and status. Each addressable and analog device shall have a field assigned 20 character zone identification message and a unique 20 character device location message.
12. The system shall provide standby batteries for complete system operation during AC power outages.
 - a. A fault condition shall be indicated when the system is operating on standby battery. When AC power is restored the system shall revert back to AC power without operator intervention or manual restart.
 - b. Each FACP shall be equipped with a battery charging circuit sufficient to recharge depleted batteries to within 70% of maximum capacity within 12 hours. Standby batteries shall be capable of supplying the system under full supervision for 24 hours. Following the 24 hour period, the system shall supply 100% general evacuation alarm output for a minimum of 5 minutes.

B. SYSTEM ALARM OPERATION

Activation of any initiating device shall initiate the following system alarm response;

1. Sound an evacuation signal in all locations within the affected building.
 - a. The evacuation signal shall consist of a steady audio signal sounding the prescribed alarm audible until silenced or reset.
2. Activate all connected visual alarm strobes in the same areas in which audible signals are activated. Upon operation of system silence, audible signals shall silence while visual signals shall continue to operate until the system is reset.
3. The alarm condition shall be visually and audibly indicated at the FACP as follows:
 - a. Illuminate a red "system fire alarm" LED indicator.
 - b. Illuminate a red "zone fire alarm" LED indicator. The indicator shall flash until the system is silenced. After the system is silenced, the zone alarm LED shall change from flashing to steady and remain illuminated until the system is reset.
 - c. Continuously sound an audible buzzer at the FACP that shall sound until the system is silenced. After silenced, the alarm buzzer shall change from a steady tone to a pulsed tone and remain active until the system is reset. It shall be possible to silence the FACP audible buzzer without causing building audible alarms to silence.
 - d. Display specific information about the alarm condition on the LCD as follows;
 - 1) Type of event.
 - 2) Numeric identification of point and zone in alarm.
 - 3) 20 character text message unique to the specific point in alarm.
 - 4) 20 character text message associated with the zone in alarm.
 - 5) An indication of the number of outstanding events in the system.
4. The system shall display the alarm condition at all remote operations and display panels. These panels shall contain the identical controls and indicators as contained on the FACP.
5. Activate the digital communicator to the central station service.
6. Activate the master box communications system to send appropriate and required signals to the fire department where applicable.



7. Operation of the system silence switch shall silence all connected audible appliances with the exception of appliances designated as not to be silenced in response to an alarm from a water-flow alarm. All displays shall remain illuminated until the system has been cleared and reset. In the event of a subsequent alarm after system silence, the FACP shall resound the building alarm signals. All audible appliances that had been previously silenced shall resound and all audible appliances programmed to respond to the new alarm condition shall activate.
8. Each event shall be individually acknowledged before the system can be returned to normal operation. Access to the acknowledge function shall be passcode restricted such that only authorized personnel may operate.
9. The system shall direct the HVAC system fans, dampers, and other equipment as indicated in the construction plans and attached schedules and in accordance with relevant local, state and national codes and standards.
10. If applicable, a system shall recall building elevators as indicated in the construction plans and attached schedules and in accordance with relevant local, state and national codes and standards.
11. Any egress doors equipped with time-delay hardware will automatically release upon power loss at the mechanism, fire alarm control panel, or alarm initiation.

C. SUPERVISORY OPERATION

The system shall activate a supervisory condition when a sprinkler tamper or dry pipe supervision input is activated. The supervisory condition shall cause the following system response:

1. The supervisory condition shall be visually and audibly indicated at the FACP as follows;
 - a. Illuminate a yellow "system supervisory" LED indicator.
 - b. Pulse an audible buzzer at the FACP that shall sound until the system is silenced.
 - c. Display specific information about the supervisory condition on the LCD as follows;
 - 1) Type of event.
 - 2) Zone and point numeric identification.
 - 3) 20-character text message unique to the specific point causing the supervisory condition.
 - 4) 20-character text message associated with the zone in the supervisory condition.
 - 5) An indication of the number of outstanding events in the system.
2. The system shall display the supervisory condition at all remote operations and display panels. These panels shall contain the identical controls and indicators as contained on the FACP.

D. DEGRADE OPERATION

In the event that the FACP main processor fails;

1. The system shall operate evacuation signals controlled by the same signaling line circuit in which an alarm initiating device has detected an alarm condition.



The system shall operate an alarm relay that shall be used to annunciate an alarm condition at a designated monitoring location.

PART 4 - PRODUCTS

4.1 FIRE ALARM CONTROL PANEL

- A. The fire alarm control panels shall incorporate all control electronics, relays, and necessary modules and components in a surface or semi-flush mounted cabinet. The operating controls and zone/supervisory indicators shall be located behind locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified. The cabinet shall be 16 GA. steel, with a permanent finish. The assembly shall contain a base panel, system power supply and battery charger with optional modules suitable to meet the requirements of these specifications.
- B. System circuits shall be capable of configuration as follows: Addressable analog loops Class A or B; Initiating Device Circuits Class A or B; Notification Appliance Circuits Class A or B.
- C. The system shall be supervised, site programmable, and of modular design with expansion modules to serve up to 96 detectors and 94 remote modules, and two notification appliance circuits (NACs) convertible to power risers to serve remote multiple NAC modules for zoned signal applications.
- D. The system shall store all basic system functionality and job specific data in non-volatile memory. The system shall survive a complete power failure intact.
- E. The system shall have built-in automatic system programming to automatically address and map all system devices and provide a minimum default single stage alarm system operation with support of alarm silence, trouble silence, drill, lamp test, and reset common controls.
- F. The system shall allow down loading of a job specific custom program created by system application software. It shall support programming of any input point to any output point. It shall allow authorized customization of fundamental system operations using initiating events to start actions, timers, sequences and logical algorithms.
- G. The system shall support distributed processor intelligent detectors with the following operational attributes; integral multiple differential sensors, automatic device mapping, electronic addressing, environmental compensation, pre-alarm, dirty detector identification, automatic day/night sensitivity adjustment, dual normal/alarm LED's, relay bases, and isolator bases.
- H. The system shall use full digital communications to supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of "same type" devices without the need of addressing and impose the "location" parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.



- I. The system shall have a U.L. Listed Detector Sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4 hours.
- J. The system shall support 100% of all remote devices in alarm and provide support for a 100% compliment of detector isolator bases.
- K. All panel modules shall be supervised for placement and return trouble if damaged or removed.
- L. The system shall have a CPU watchdog circuit to initiate trouble should the CPU fail.
- M. The system evacuation signal rate shall be continuous.
- N. Audible notification appliances shall be affected by signal silence features. Visual signal appliance shall not be affected by signal silence features.
- O. The system program shall meet the requirements of this project, current codes and standards, and satisfy the local Authority Having Jurisdiction.
- P. Passwords shall protect any changes to system operations.
- Q. All levels of passwords shall be provided to the system owner (GSU).
- R. The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. Input power shall be 120 VAC, 60 HZ. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc at 4A continuous for notification appliance circuits. The power supply shall be capable of providing 10A to output circuits for a maximum period of 50 ms. Auxiliary power shall be 24 Vdc at 500 mA. All outputs shall be power limited. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 5 minutes.
- S. Auxiliary Power Supply: Provide where required a switching power supply that provides auxiliary 24 VDC power for system devices (conventional detectors and indicating appliances).
 - 1. Brownout and loss of AC power shall cause automatic changeover to connected standby battery supply sized to provide for the attached load in accordance with control equipment specifications.
 - 2. AC line, battery condition and output wiring ground faults shall be monitored by the power supply and signaled to the FACP via the signaling line circuit. A Ground Fault LED shall be provided on the power supply unit. Battery condition monitoring shall include low voltage, missing batteries, reverse connection and shorted battery connection. Reverse and shorted battery connections shall not damage the power supply.
 - 3. The power supply assembly shall consist of the power supply/battery charger mounted within a dedicated and locked enclosure designed for surface wall mounting.
 - 4. The power supply shall provide a regulated 24 VDC output at 4 Amps. Power supply outputs shall meet NFPA standards for power limited/class 2 circuits.



- T. The LCD Display Module shall be of membrane style construction with a Liquid Crystal Display. The LCD shall use backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disabled points. In the alarm mode display the total number of events and the type of event on display. Reserve 40 characters of display space for user custom messages. The module shall have visual indicators for the following common control functions; AC power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be common control keys and visual indicators for; reset, alarm silence, trouble silence, drill and forward / backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicators to flash the indicators when un-displayed events are available for display and turn on steady when all events have been displayed. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program, and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.
- U. The Main Controller Module shall control and monitor all local or remote peripherals. It shall support the LCD Display Module, power supply, remote LCD and zone display annunciators, strip and carriage printers, and support communication interface standard protocol (CSI) devices such as color computer annunciators and color graphic displays. The RS-485 port shall be capable of supporting up to 32 remote annunciators. The MCM shall provide one loop controller circuit, two notification appliance circuits, and common form 'C' contacts for alarm, supervisory, and trouble. Contact ratings shall be 24 Vdc at 1A.
- V. The panel shall have:
1. An interface module for remote site monitoring. The module shall have a local energy municipal loop and reverse polarity connections for each of alarm, supervisory and trouble.
 2. Zone display indicator modules to annunciate zones per the fire alarm zoning schedule.
 3. The following conditions shall be indicated on the 80-character alpha-numeric display mounted on the face of the Fire Alarm Control Panel and Remote Annunciator:
 - a. AC Power.
 - b. System Alarm.
 - c. Supervisory Device Alarm.
 - d. System Trouble.
 - e. Signals Silenced.
 - f. Module Failure.
 - g. Power Trouble.
 - h. Initiating Device Alarm.
 - i. Initiating Device Trouble.
 - j. Indicating Circuits Trouble.
 - k. Alarm Relay On.
 - l. Alarm Relay Trouble/Disable.
 - m. Remote Signaling On.
 - n. Remote Signaling Trouble.
 4. The following switches shall be provided on the FACP:



- a. Acknowledge.
- b. Signal Silence.
- c. System Reset.
- d. Disable/Enable.
- e. Indicating Circuits ON/OFF.
- f. Alarm Relay ON/OFF.
- g. Remote Signaling ON/OFF.
- 5. Fire Alarm Control Panel shall be provided as follows:
 - a. Selectable alarm verification and acknowledged.
 - b. Selectable trouble acknowledge.
 - c. Self-contained audible alarm system.
 - d. Self-contained audible trouble system.
 - e. Municipal master box and reverse polarity connection circuit.
 - f. Transient suppression module for municipal connections and power supply.
 - g. Alarm/trouble one man walk test.
 - h. Alarm resound.
 - i. Battery, ground, and AC power supervision.
 - j. Control relay module.

4.2 REMOTE ANNUNCIATION

- A. Remote Operations and Display Units shall be provided when required. Each Fire Alarm Control Panel (FACP) shall be capable of supporting multiple remote units.
- B. Each remote unit shall be equipped with identical controls and displays as found on the FACP.
- C. Remote Operations and Display Units may be powered locally or from the FACP and shall be fully supervised by the FACP. In the event of loss of local power or a failure in communications to a remote unit, both the FACP and remote unit(s) shall audibly and visually annunciate the fault condition.
- D. Remote units shall be able to be located anywhere throughout the facility over twisted pair cabling.
- E. Annunciator switches may be programmed for system control such as, global acknowledge, global signal silence, global system reset, and on/off control of any control point in the system.
- F. The alphanumeric display annunciator shall be a supervised, locally or remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
- G. The LCD annunciator shall display all alarm and trouble conditions in the system.
- H. LCD display annunciators shall mimic the main control panel 80-character display and shall not require special programming.



4.3 FIRE ALARM NOTIFICATION APPLIANCES AND EQUIPMENT

- A. General Notification Appliances (if applicable)
 - 1. All appliances shall be U.L. Listed for Fire Protective Service.
 - 2. All strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971, UL 1638, and ULC S526 Listed.
- B. Furnish and install where shown on the plans.
- C. Addressable Indicating Circuit Module: The addressable indicating circuit modules will be provided and installed to activate indicating appliances connected to its sub-circuit in response to command from the control equipment.
 - 1. The module shall interface to the alarm signaling appliances via a supervised, Style Y sub-circuit and shall be rated for 3 AMP output. All signaling appliances attached to the sub-circuit shall report their status and be activated as a single identity. The module shall be UL compatibility listed for use with the conventional 24 VDC type bells, horns and strobes used in this project.
 - 2. The Fire Alarm Vendor shall provide line voltage drop calculations that shall demonstrate that the voltage supplied at all indicating appliances is above the UL specified minimum for the indicating appliances employed. These calculations shall assume operation on standby batteries after the required standby period. Therefore, a battery output of 20.4VDC shall be used in these calculations. The contractor shall provide sufficient quantities of addressable indicating circuit modules and 24 VDC power supplies, in the proper locations, to ensure that the UL specified minimum voltage is present at all indicating appliances.
 - 3. The module shall communicate with the FACP via the signaling line circuit, providing information of identity, location and status. The indicating circuit module shall require one address on the signaling line circuit.
 - 4. The indicating circuit module shall provide separate terminals for connection to indicating appliance operating power from a UL listed 24 VDC power supply. The module shall supervise the presence of this power. Indicating circuit modules that require an external power supervisory device or an additional module to supervise the presence of indicating appliance power will not be accepted.
 - 5. The module shall supervise for relay coil failure.
- D. Visual Indication and Audible Notification Appliances (if applicable)
 - 1. All strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971, UL 1638, and ULC S526 Listed.
 - 2. Strobes shall operate on 24 VDC nominal.
 - 3. Strobes shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:
 - a. The maximum pulse per UL 1971.
 - b. Candela intensity shall meet the requirements of UL 1971.
 - c. The flash rate shall meet the requirements of UL 1971.



- d. The 75 cd appliance shall be placed 80 in (2,030 mm) above the highest floor level within the space, or 6 in (152 mm) below the ceiling, whichever is lower unless otherwise indicated. The 115 cd strobe, UL 1971 listed for ceiling mounting, shall be placed at the bottom of the bar joist centered directly over the respective aisle.
4. Indoor devices shall be mounted on 4" square outlet boxes, surface mounted on columns in the sales area, flush mounted in the office or the interior side of tilt walls or block.
5. Outdoor devices shall be mounted on 4" square cast weatherproof outlet boxes (2 gang Bell box). Strobes shall have outlet boxes with weatherproof covers. Horns shall be of the weatherproof type.
6. Horns shall be minimum 83 dBA and mounted on the bottom of the bar joist unless otherwise indicated.
7. Speakers for mass notification system.

4.4 INITIATING DEVICES, EQUIPMENT, AND FIELD MODULES

A. General - Intelligent Addressable Analog Devices

1. Furnish and install where indicated on the plans.
2. Dependent on its functionality each device shall be capable of monitoring up to 32 diagnostic codes. This data shall be stored at the device and available for system maintenance.
3. Each device shall be capable of performing its intended function independent of the control panel to lower loop data traffic. Each device shall immediately alert the loop controller of a status change to achieve a loop response time of less than 500 ms.
4. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary.
5. Each detector shall continually monitor the environmental impact of temperature, humidity, barometric pressure and air-borne contaminants. The process shall adapt the detector to long term environmental changes and signal the loop controller when the detector approaches 50% and 100% of the allowable environmental compensation value.
6. Differential sensing algorithms shall maintain a constant sensitivity setting between the alarm threshold and a compensated base line sensitivity. The base line sensitivity shall be updated approximately once every hour.
7. Each detector shall have a separate means of displaying communication and alarm status. An LED shall flash to confirm communication. A solid LED shall display an alarm status. LED's shall be visible through a full 360 degree viewing angle.
8. Each detector shall be capable of transmitting pre-alarm and alarm signals.
9. All detectors shall be suitable for wall mount applications.

B. Ceiling Mounted Fire Sensors

1. Addressable smoke and thermal detectors shall provide alarm and power/polling LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and shall be



- placed into steady illumination by the control panel, indicating that an alarm condition has been detected.
2. Smoke detector sensitivity shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
 3. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
 4. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
 5. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself or initiated remotely on command from the control panel.
 6. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL, MULTI SENSOR).
 7. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The system operator shall view the current analog value of each detector at the FACP.
 8. Addressable devices shall provide address-setting means and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
 9. Intelligent Photo Detector shall use a light scattering type photo sensor. The detector shall be suitable for area protection and direct insertion into air ducts up to 3 feet high and 3 feet wide with air velocities up to 5000 ft./min. without requiring specific duct detector housings or supply tubes. The detector shall have a ULI Smoke Sensitivity Range 0.67 - 3.77 % Obscuration/ft. The detector shall be rated for ceiling installation at a minimum of 30 foot centers.
 10. Intelligent Ion Detector shall be a unipolar ionization smoke sensor. The detector shall operate in constant air velocities from 0 to 75 ft./min. and in intermittent air gusts up to 300 ft./min. for up to 1 hour. It shall have a ULI Smoke Sensitivity Range of 0.61 - 1.91% Obscuration/ft. The operating environment shall be restricted to elevations up to 5000 ft. The ion detector shall be rated for ceiling installation at a minimum of 30 foot centers.
 11. Fixed Temperature/Rate-of-Rise Heat Detector shall have a low mass thermistor and operate at a nominal fixed temperature of 135°F and at a temperature rise at or exceeding 15°F per minute. It shall have a minimum linear space rating of 70 foot centers.
 12. Intelligent Fixed Temperature Heat Detector shall have a low mass thermistor and operate at a fixed temperature of 135°F. It shall have a minimum linear space rating of 70 foot centers.
 13. Detector bases shall mount to North American 1 gang, 3 1/2 " or 4" octagon boxes, and a 4" square box. Removal of the respective detector shall not affect



communications with other detectors. Terminal connections shall be made on the room side of the base. All detectors shall be compatible with any base.

C. Intelligent Duct Smoke Detectors

1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. An auxiliary relay will interrupt fan motor starter control voltage thereby rendering the fan motor inoperable.
3. Provide and install LED source, addressable air duct photo-electric smoke detectors and integral twist-lock bases at locations as indicated on the drawings. Air duct smoke detector shall utilize same detector head as ceiling mounted photo-electric detector.
4. Detector sampling tubes and housings shall be provided by the Fire Alarm/Life Safety System Vendor to the mechanical contractor for installation in all roof top HVAC units 2,000 CFM.
5. Sampling tube length and tube openings shall be coordinated by the electrical contractor with the mechanical contractor. Detectors shall be installed where indicating LED can be visually inspected from the sales floor below, but as high in the ductwork as possible.

D. Addressable Pull Station (manual alarm initiation)

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters.
4. Stations shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

E. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect supervised IDC zones of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone may be wired for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.



F. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.

G. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted back-box. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

H. Fire Protection System Alarm and Supervisory Equipment

1. Water-flow switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Water-flow switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All water-flow switches, gate valve supervisory switches, post indicator valve supervisory switches, actuation solenoid and related release equipment, and waterflow alarm gongs shall be provided and installed by the sprinkler system contractor. All AC voltage pipe and wiring for the air compressors is the responsibility of the Electrical Contractor.
4. All conduit and wiring for the sprinkler switches and alarm bell(s) shall be provided by the electrical contractor. Provide 4" octagon junction box on closest structural wall to device. Flexible conduit with circuit conductors shall be



provided by the electrical contractor. Final connection shall be provided by the Electrical Contractor.

5. Each sprinkler system water supply control valve riser and zone control valve shall be equipped with a supervisory switch.
6. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
7. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
8. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
9. The switch housing shall be finished in red baked enamel.
10. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
11. Valve supervisory switches shall be connected under this section and provided and installed by sprinkler contractor.

I. 1.11 MASS NOTIFICATION

- A. Mass notification is the capability to provide real-time information to all building occupants or personnel in the immediate vicinity of a building during emergency situations. To reduce the risk of mass casualties, there must be a timely means to notify building occupants of threats and what should be done in response to those threats. Pre-recorded and live voice emergency messages are required to provide this capability.
- B. Failure of either the mass notification control panel or the fire alarm control panel shall still provide for a minimum means of occupant notification by the remaining system.
- C. The mass notification panel shall be interfaced with the building Fire Alarm System specified, for the delivery of alert tones and voice messages. Tones and voice messages initiated by the mass notification panel shall mute all other programs such as music, paging or prerecorded commercial announcements.
- D. All equipment furnished shall be new and the latest state of the art products by manufacturers, engaged in the manufacturing and sale of analog fire detection and/or UL listed communication devices for over five years.
- E. The system shall be a multi-channel voice evacuation system incorporating user selectability of 8 distinct sounds for tone signaling, and the incorporation of a digital voice module for prerecorded messaging. The system shall incorporate microphone override. The system shall have the capability of utilizing a remote microphone station with redundant controls of the evacuation system control panel.
- F. A hand-held microphone shall be provided and, upon activation, shall take priority over any tone signal, recorded message or remote microphone operation in progress, while maintaining the strobe NAC Circuits activation.



- G. The system shall be capable of interconnection with a larger campus/base wide notification system that includes operation from a central communication center.
 - H. Prior to commissioning of the Mass Notification System the installing contractor shall obtain approval of the Emergency Response Plan and Emergency Messages from the GSU Director of Emergency Management.
 - I. The system as specified is subject to review, full testing, and approval by each of the Authorities Having Jurisdiction, and shall be turned over to the owner in an operational condition.
 - J. See the end of this specification for the GSU mass notification Emergency Messages.
- 4.12 The contractor shall provide a representative as requested for project meetings such as to assist in coordination of crafts. OFF PREMISES REPORTING EQUIPMENT
- A. Provide a Digital Alarm Communicator Transmitter (DACT) for reporting alarm, trouble and supervisory conditions to a remote central station using telephone communication lines.
 - 1. The DACT shall mount within or next to the FACP enclosure.
 - 2. The DACT shall include a built-in 0-90 second programmable delay.
 - 3. The DACT shall monitor the telephone lines for trouble.
 - 4. The DACT shall have a programmable delay for reporting of AC power loss.
 - B. Provide all equipment, connections, and testing in order to provide all master box communications to the Fire Department where applicable.

PART 5 - EXECUTION

5.1 PRE-CONSTRUCTION ON-SITE MEETING

- A. The Installing Contractor, Design Professional and Owner shall be responsible to attend an on-site pre-construction meeting. Pre-Construction Meeting shall be coordinated ten (10) business days prior to meeting date.

5.2 GENERAL

- A. Installation of the fire alarm system shall be in strict compliance with manufacturer's recommendations. Consult the manufacturers control panel and peripheral equipment installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/ termination/ wiring data.
- B. Fastening and supports of all equipment shall be adequate to support the required load, and provide a safety factor of five.
- C. As indicated on the Fire Alarm Vendor shop drawings, each system alarm point or zone in the system shall be uniquely labeled within the fire alarm control panel. Names of the system point (s) / zone (s) shall be as defined by or in consultation with the Owner and/or Architect.



- D. Fire sprinkler water flow switch activation shall each be indicated on a separate zone in the fire alarm control panel.
- E. Fire alarm control panel will be mounted with the center of the panel 60 inches above floor level.

5.3 CABLE AND WIRING

- A. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the electrical panel as "FIRE ALARM" and the circuit breaker shall be effectively locked out with an approved, listed breaker lock device. The control panel cabinet shall be grounded securely to the main building ground. Conduit shall enter into the fire alarm control panel only at those areas of the back-box which have factory conduit knockouts.
- B. Provide all line voltage (120 V. max.) and low-voltage (up to 50 VAC/VDC) circuiting in separate conduit. Wiring shall be in accordance with local, state and national codes (i.e. NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for Initiating Device Circuits and Signaling Line Circuits, and 16 AWG for Indicating Appliance Circuits. All cable must be in conduit in exposed locations. Cable in concealed locations will be neatly routed and supported on J hooks.
- C. Branch wiring from control and monitor modules to controlled and monitored points shall be minimum #16 AWG-CU paired cable (not necessarily twisted) or as per manufacturer's recommendations. Wiring for addressable and data transmission connections shall be minimum #16 AWG-CU, low capacitance, shielded twisted pair or as per manufacturer's recommendations. Control panel to annunciator cable shall be one pair RS-485 (communication) and one-pair #16 AWG-CU (24 VDC Power) or as per manufacturer's recommendations. All cable jackets shall be red in color to readily identify it as fire alarm cable.
- D. All wire terminations shall be stripped and landed by the Electrical Contractor. The Electrical Contractor will provide not less than 18" slack wire at devices, and 6'-0" slack wire at the control panel for final termination.
- E. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; an audible and visual trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

5.4 CONDUITS AND BOXES

- A. Conduit shall be provided by the electrical contractor.
- B. All cable must be in conduit in exposed locations.



- C. The electrical contractor shall provide all junction boxes and cover plates per manufacturer's instructions and details. All electrical junction boxes shall be labeled as "fire alarm system" with decal or other approved markings.
- D. Paint all exposed raceways to match adjacent surfaces on walls. At exposed structures with no ceiling, raceways shall be painted red. All fire alarm system junction boxes shall be painted red. Provide conduit identification band markers at required locations based on raceway layout.

5.5 END OF LINE RESISTORS

- A. The Fire Alarm Vendor shall provide all end-of-line resistors to match impedance of circuit served per manufacturer's instructions.

5.6 IDENTIFICATION

- A. The Electrical Contractor shall number code conductors appropriately and permanently, as indicated on the Fire Alarm Vendor shop drawings, for identification, device installation, and servicing of the system. Labeling shall clearly identify the circuit, zone, and/or device served.

5.7 PROJECT 50% COMPLETION ON SITE QUALITY ASSURANCE

- A. The installing contractor shall coordinate with the General Contractor, Design Professional and the GSU Project Manager a 50% on-site inspection once the projects progress of FA installation is at 50%, ten (10) business days in advance.

5.8 PROJECT COMPLETION PUNCH WALK

- A. The installing contractor shall coordinate with the Design Professional and the GSU Project Manager upon completion of the installation as outline in 1.12 General, an inspection for material completion (Punch walk) 10 business days in advance. The Punch walk must be accepted prior to a Final System Acceptance Testing to be performed.

5.9 FINAL SYSTEM ACCEPTANCE

- A. The system will be accepted only after a satisfactory test of the entire system has been accomplished by the installing electrician and a factory-trained representative from the fire alarm vendor in the presence of a representative of the local authority having jurisdiction and the GSU representative. At the completion of the project, full documentation shall be presented to the GSU representative indicating acceptance testing has been approved per NFPA 72, Chapter 7 and a Certificate of Compliance per NFPA 72.1-7.2.1
- B. Final acceptance will require the electrical contractor to deliver to the Engineer the following:
 - 1. Three (3) copies of the operating instructions and system maintenance manuals.
 - 2. Three (3) sets of record drawings (as built drawings).
 - 3. Three (3) copies of the final test reports.



4. Three (3) copies indicating the name and phone number of person to contact in the event of equipment failure, and date when system warranty will terminate.
 5. Three (3) sets of data sheets for each piece of equipment supplied.
 6. Electronic media (CD-ROM including CADD) files in PDF format, Autodesk DWF format, or other electronic media approved by the Owner.
- C. The Fire Alarm System Vendor shall provide the customer with a minimum of two (2) inspection and test visits during the first year. During this time, each field device shall be tested at least once, and the control panel shall be tested during each inspection. A written report shall be submitted to the customer indicating what devices and how they were tested. Any problems with system other than equipment, such as customer owned equipment blocking detection, manual stations or indicating devices shall be listed in the written report to the customer.
- D. The Fire Alarm System Vendor shall provide to GSU a contracted periodic system testing, maintenance, inspection, and/or calibration services as well as signal monitoring service.
- E. The Fire Alarm System Vendor shall schedule a 100% functional fire alarm acceptance test with the GSU representative and Architect. This test is in addition to the tests required by the local Authority having Jurisdiction for the certificate of occupancy. The test shall be in accordance with NFPA 72. Test shall be performed after the complete installation of all systems (i.e. connection to high volume low speed fans, connections to delayed egress hardware, HVAC units, etc.). Contractor shall budget one day of testing (with GSU's representative) and have two (2) personnel on site, familiar and involved with the installation. The contractor shall furnish all personnel, lifts, hand tools, radios and any other equipment needed for testing.

5.10 ON-SITE SERVICES

- A. The Fire Alarm System Vendor shall provide the on-site services of an authorized, factory trained technical representative to supervise all connections and fully test all devices and components of the system during installation.
- B. The Fire Alarm System Vendor shall provide training on the operation, proper use, and testing of the installed fire alarm system to the GSU representative (and the local authorities having jurisdiction, when required).

5.11 WARRANTY

- A. The fire alarm system as specified above shall be warranted for a period of one year from date of acceptance by the Fire Alarm System Vendor. The warranty shall cover parts, labor and travel to and from site.

5.12 EMERGENCY MESSAGES

- A. All Clear" - This is a Georgia State University Emergency Broadcast. This is an 'ALL CLEAR' notification for _insert event_. Repeat – this is an 'ALL CLEAR' notification for _insert event_. The insert scene, location or event is deemed safe. Resume normal operations at this time. For more information, please check www.gsu.edu



- B. Bomb Threat - This is a Georgia State University Emergency Broadcast. A bomb threat has been reported in __insert Building. If you are in this building, do not use radios or cell phones to communicate. Proceed calmly to an outdoor location and move at least 300 feet away from the building. DO NOT RETURN until the Police give an all clear. For more information, please check www.gsu.edu for more info.
- C. Campus-wide Evacuation - This is a Georgia State University Emergency Broadcast. Due to __insert event __, President Becker has declared a campus state-of-emergency and closed the University. All personnel not associated with emergency response are asked to stay away from campus until further notice. If you are on campus, please follow your building evacuation plan and follow the orders of the Police. For more information, please check www.gsu.edu
- D. Chemical Spill (Internal) - This is a Georgia State University Emergency Broadcast. A chemical spill has occurred in _insert building. Please evacuate the ____ floor(s). Before leaving, please turn off burners and other heating devices and cover open chemical containers. For more information, please check www.gsu.edu
- E. Crime Lookout - This is a Georgia State University Emergency Broadcast. University Police have issued a state of heightened alert. Be on the lookout for insert description. Do not approach this person (persons) or try to apprehend them. If you are out doors or in a parking deck, take shelter in the nearest University Building. If you see this person, move to a safe area and immediately contact the police. For more information, please check www.gsu.edu
- F. Fire (Evacuation) - This is a Georgia State University Emergency Broadcast. A fire has been reported in _insert building. If you are in the _insert building, please evacuate the building by using the stairwells and move to your established assembly area. Do not use the elevators and impede the Fire Department's response. For more information, please check www.gsu.edu
- G. Flooding - This is a Georgia State University Emergency Broadcast. A flood has occurred in this building. Please remove all papers and other valuables off the floor and move the materials to a safe area. For more information, please check www.gsu.edu
- H. National Terrorism Alert - This is a Georgia State University Emergency Broadcast. Due to __insert event__ and uncertainty of the threat, President Becker has suspended University operations. All classes are suspended until further notice. If you choose to leave campus, please leave in an orderly manner and follow Police instructions. It is recommended that public transportation be utilized as automobile routes away from campus will most likely be gridlocked. For more information, please check www.gsu.edu.
- I. Shelter-(Crime) - This is a Georgia State University Emergency Broadcast. University Police have declared a local state of emergency due to __insert event__. Take immediate shelter in the nearest University Building. Personnel in offices and classrooms should lock their doors. For more information, please check www.gsu.edu
- J. Shelter – (Hazmat) - This is a Georgia State University Emergency Broadcast. A hazardous material spill has been reported near __insert location__. Take immediate shelter in the nearest University Building. Do not shelter in automobiles or parking decks.



Keep all windows and doors closed. Move to the upper floors of the Building and await further instructions. For more information, please check www.gsu.edu

- K. Shelter – (Local Emergency) - This is a Georgia State University Emergency Broadcast. Due to __insert event __ in the local community, University Police have issued an alert notification. Remain on-campus until notified otherwise. Do not use your automobile to leave campus. If you are approaching campus, stay away until further notice. Keep all streets clear for emergency vehicles. You may continue with business as normal within the buildings. More details will be given as they are received. For more information, please check www.gsu.edu
- L. Tornado Warning - This is a Georgia State University Emergency Broadcast. A TORNADO WARNING has been issued for Fulton County. Take immediate shelter into the interior of the building, a central stairway, restroom or the basement. Stay away from windows and glass doors. DO NOT USE THE ELEVATORS. If you hear the tornado, crouch down and cover your head. Remain sheltered until you receive an all clear notice.
- M. Winter Storm (Ice) - This is a Georgia State University Emergency Broadcast. Due to inclement winter weather, President Becker has decided to close the University effective __ insert date / time__. Please use caution in your travels off campus. Monitor www.gsu.edu for updated information.

END OF SECTION



DIVISION 31 00 00 - EARTHWORK

General:

Top Soil must be placed over all areas to be grassed or planted. Depth of topsoil shall be a minimum of six (6) inches. Top soil shall be specified as follows:

Top soil shall be natural, friable, fertile, fine loamy soil possessing the characteristics of representative top soils in the vicinity which produce a heavy growth; free from subsoil, weeds, litter, sod, stiff clay, stones larger than one (1) inch in diameter, stumps, roots, trash, toxic substances, or any materials which may be harmful to plant growth or hinder planting operations; having a minimum PH of 6.0 and a maximum PH of 7.0 and obtained from naturally well drained areas which have never been stripped before. Top soil shall not be delivered in a frozen or muddy condition.

Asphaltic Concrete Paving must conform to the Georgia Department of Transportation standard specifications for highway construction. The surfacing course shall be a minimum of 1 ½" thick. The base course shall be a minimum of 2" thick. The subbase for asphaltic concrete paving must be a minimum of 6" GAB.

End of Section



DIVISION 32 00 00 - EXTERIOR IMPROVEMENTS

Irrigation System:

Generally, irrigation systems are required for all landscaped areas.

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).

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

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.

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

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.

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.

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

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

Communication wire must meet all Maxicom specifications.

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

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

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

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

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

Any Maxicom hardware must be installed by a certified installer.



Walks and Pavements:

Provide adequate slope to prevent standing water.

Wooden feature strips shall not be used.

No exposed aggregate or pigmented concrete shall be used.

All concrete walks shall be reinforced with wire mesh or rebar. Unreinforced concrete flatwork is unacceptable.

Concrete Pavers shall be considered at entrances to buildings or major quad and open spaces.

Site Furnishings:

Benches: Victor Stanley RB-28, 6' length, Steelsites Series, powder coated blue at the Downtown Campus and black at the 5 Satellite Campuses.

Litter Receptacle: Victor Stanley S-42 Ironsites Series, powder coated blue at the Downtown Campus and black at the 5 Satellite Campuses.

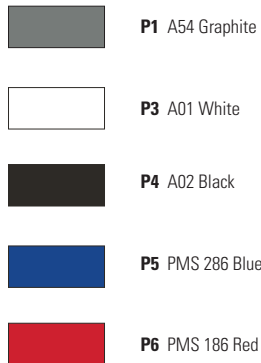
Bike Racks: Dero HRHD, In-ground Mount, Powder Coated Iron Gray 7011.

Picnic Tables: Wabash Valley Camino Series 42" perforated round tables with 4 or 5 attached perforated chairs. Finish shall be powder coated blue at the Downtown Campus and black at the 5 Satellite Campuses.

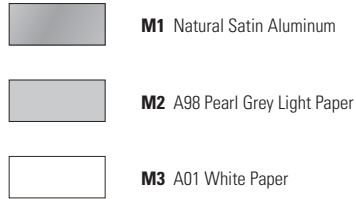
END OF SECTION

1 Project Finishes

Paint / Print Colors



Metal Finishes & Paper Color



Appendix A - Interior Signage

2 Project Typefaces

Typeface 1 - HelveticaNeue-Roman

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 0123456789

Typeface 2 - HelveticaNeue-Bold

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 0123456789

Typeface 3 - HelveticaNeue-Light

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 0123456789



PROJECT
Interior
Signage Standards

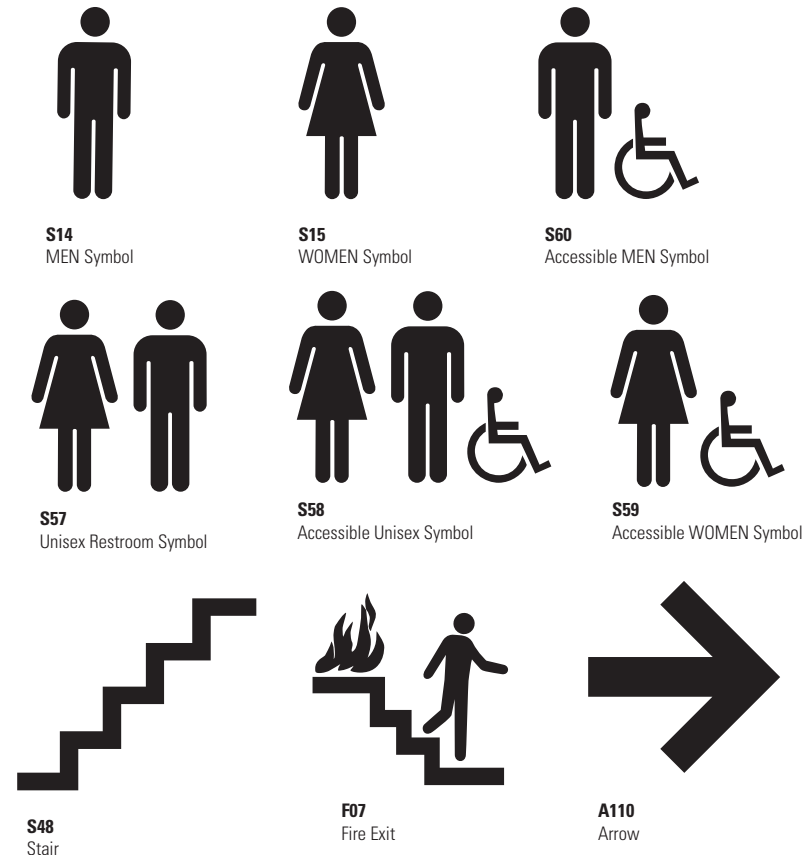
Initial Concepts

SCALE
N/A

SALES REP
Sherry Beauvais
SIGN PLANNING

WO #

3 Standard Symbols



4 GSU Logos

GEORGIA STATE UNIVERSITY



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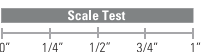
DATE
12.12.2022

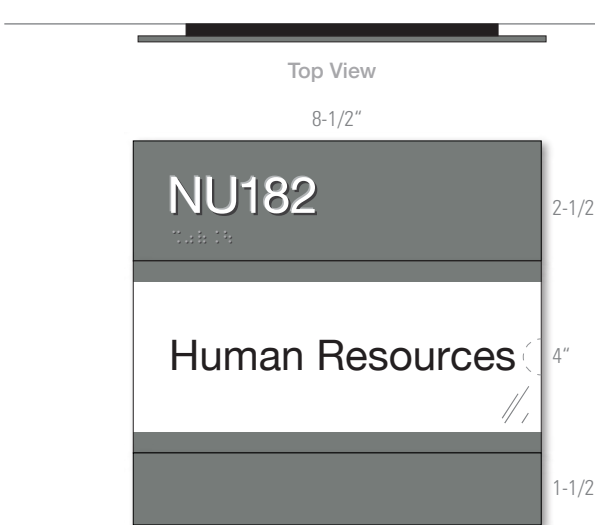
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Sign Type A.1

Office Classroom Sign

SC Series Elevate EV85 (No Reveal)
Overall Size: 8" x 8 1/2"
Mounting: Vinyl Tape (VT)

Sintra Backer:

Size: 7" x 6-1/2" x 1/4"
Color: A02 Black

Top Insert Part Code: EV-341A-DPT

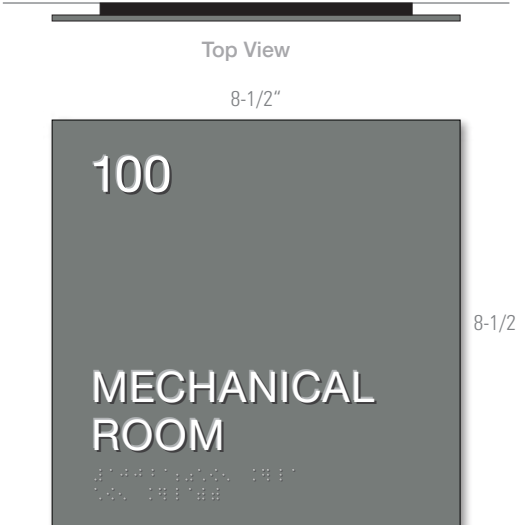
Size: 2 1/2" x 8 1/2" x 1/8"
Color: A54 Graphite
Direct Print Tactile Graphics (DPT)
Copy: HelveticaNeue-Roman (HR)
Size: 3/4"
Color: A01 White
Braille Color: Same as background

Center Insert Part Code: EV-WIN (Window)

Size: 4" x 8 1/2"
Rule Color: A54 Graphite
Paper Color: A01 White (By others)

Bottom Insert Part Code: EV-341A

Insert Size: 1 1/2" x 8 1/2"
Acrylic Color: A54 Graphite



Sign Type B.1

Mechanical/Electrical/
Custodial/IDF Rooms Sign

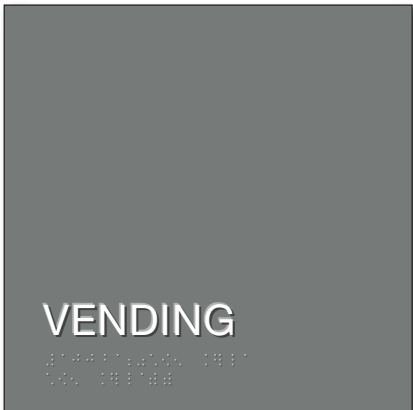
SC Series Elevate EV85 (No Reveal)
Mounting: Vinyl Tape (VT)

Sintra Backer:

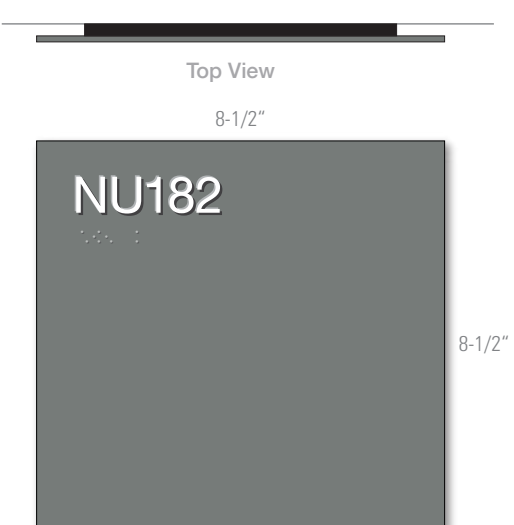
Size: 7-1/2" x 6-1/2" x 1/4"
Color: A02 Black

Part Code: EV-341A-DPT

Overall Size: 8 1/2" x 8 1/2"
Color: A54 Graphite
Direct Print Tactile Graphics (DPT)
Copy: HelveticaNeue-Roman (HR)
Size: 3/4", 5/8"
Color: A01 White
Braille Color: Same as background



ALT. Layout for Sign Type B.1



Sign Type B.2

Room Number Sign

SC Series Elevate EV85 (No Reveal)
Mounting: Vinyl Tape (VT)

Sintra Backer:

Size: 7-1/2" x 6-1/2" x 1/4"
Color: A02 Black

Part Code: EV-341A-DPT

Overall Size: 8 1/2" x 8 1/2"
Color: A54 Graphite
Direct Print Tactile Graphics (DPT)
Copy: HelveticaNeue-Roman (HR)
Size: 3/4"
Color: A01 White
Braille Color: Same as background



ALT. Layout for Sign Type B.2



PROJECT

Interior
Signage Standards

Design Concepts

SCALE

1/4" = 1"

SALES REP

Sherry Beauvais

SIGN PLANNING

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Scale Test

0" 1/4" 1/2" 3/4" 1"



Sign Type C.1
Conference Room / Vacant / In Use

SC Series Elevate EV85 (No Reveal)
Mounting: Vinyl Tape (VT)
Overall Size: 8 1/2" x 8 1/2" x 1/8"(thick)
1/4" Radius Corners
Color: A54 Graphite

Sintra Backer:
Size: 7-1/2" x 6-1/2" x 1/4"
Color: A02 Black

Top Insert Part Code: EV-341A-DPT
Size: 5 1/2" x 8 1/2" x 1/8"
Color: A54 Graphite
Direct Print Tactile Graphics (DPT)
Copy: HelveticaNeue-Roman (HR)
Size: 3/4", 5/8"
Color: A01 White
Braille Color: Same as background

Center Insert Part Code: EV-SL (Slider)
Slot Color: Natural Satin
Slider Color: Color: A54 Graphite
Copy: HelveticaNeue-Roman (HR)
Size: 3/8"
Copy Color: A54 Graphite

Bottom Insert Part Code: EV-341A
Acrylic Color: A54 Graphite



Sign Type C.2
Conference Room / Window & In Use Slider

SC Series Elevate EV85 (No Reveal)
Mounting: Vinyl Tape (VT)
Overall Size: 12 1/2" x 8 1/2" x 1/8"(thick)
Color: A54 Graphite

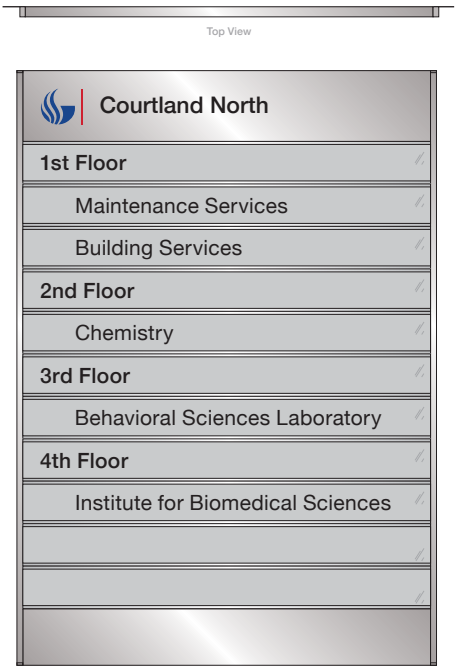
Sintra Backer:
Size: 11-1/2" x 6-1/2" x 1/4"
Color: A02 Black

Top Insert Part Code: EV-341A-DPT
Size: 5 1/2" x 8 1/2" x 1/8"
Color: A54 Graphite
Direct Print Tactile Graphics (DPT)
Copy: HelveticaNeue-Roman (HR)
Size: 3/4", 5/8"
Color: A01 White
Braille Color: Same as background

Center Insert Part Code: EV-WIN (Window)
Size: 4" x 8 1/2"
Rule Color: A54 Graphite
Paper Color: A01 White (By others)
1/2" Thumb Slot routed into bottom insert

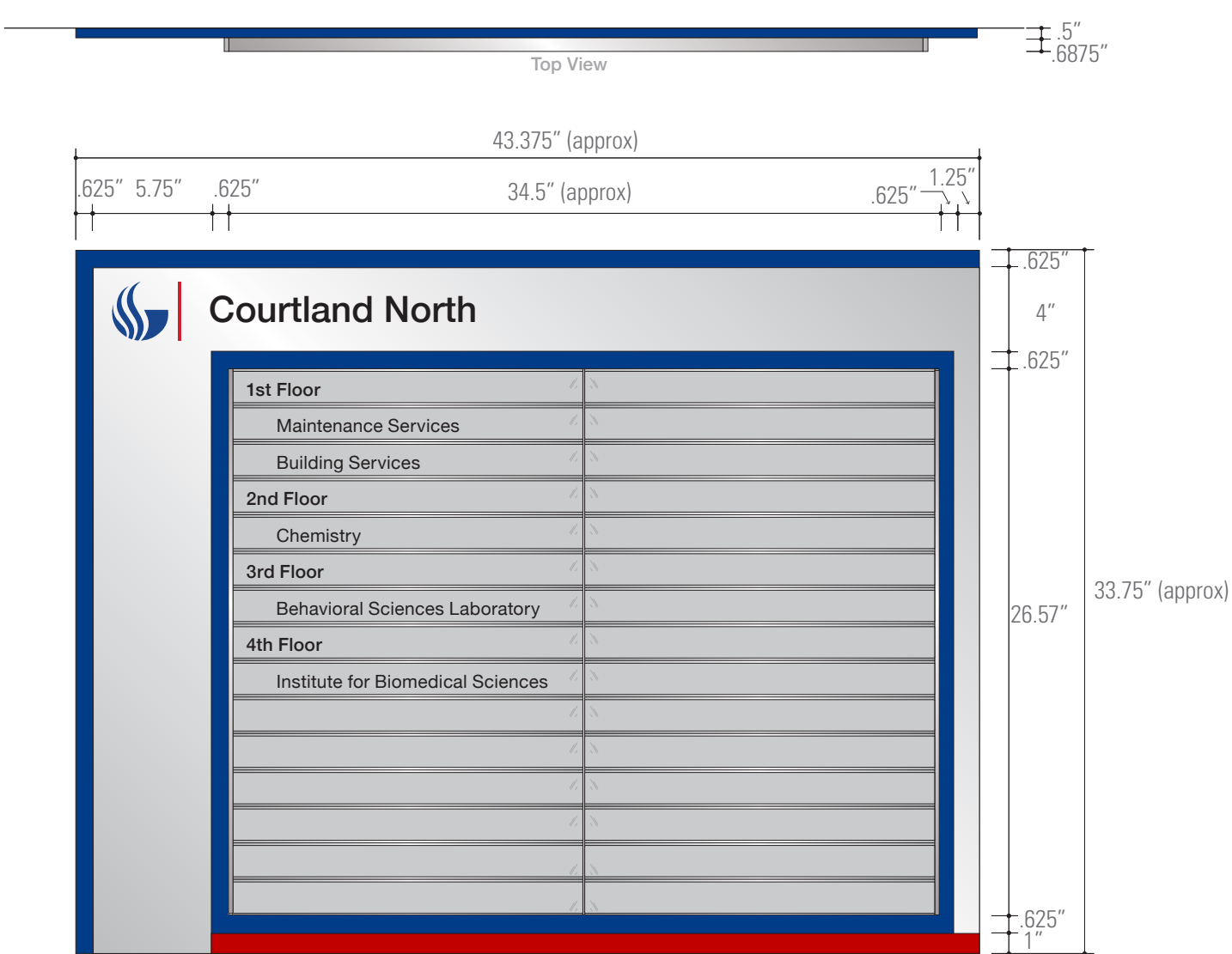
Bottom Insert Part Code: EV-SL (Slider)
Slot Color: Natural Satin
Slider Color: Color: A54 Graphite
Copy: HelveticaNeue-Roman (HR)
Size: 3/8"
Copy Color: A54 Graphite

Bottom Insert Part Code: EV-341A
Acrylic Color: A54 Graphite



Sign Type D.1
Small Building Directory
Accord 15 Series Individual Strips
Mounting: Mechanically Fastened

Side Track Code: SBST-S (Square)
OD Size: 24.79" x 17-1/2"
Color: Natural Satin
Header Insert Code: SB75
Size: 2.9" x 17"
Finish: Natural Satin Aluminum
GSU Logo Size: 1 1/2"
Color: PMS 286C Blue
Accent Line Color: PMS 186 Red
Copy: Helvetica Neue Medium
Copy Size: 5/8"
Color: A02 Black
IS Insert: IS4517
Finish: Natural Satin Aluminum
Size: 45mm x 17" (1.77" x 17")
Quantity Shown: 11
Paper Strips Color: A78 Pearl Grey Paper
Copy: Helvetica Neue Medium & Roman
Size: 5/8"
Color: Black Laser Printed
Base Insert Code: SB60
Size: 2 3/8" x 17"
Finish: Natural Satin Aluminum



Sign Type D.2
Medium Building Directory
Accord 15 Series Individual Strips
Mounting: Mechanically Fastened
Overall Size of Display: 33.75" (approx.) x 43.375" (approx.) x 1.1875"

Accord 2 Column "Directory"
Accord display mounts to backer, whole assembly mechanically fastened through Accord
Overall Accord Size: 26.57" x 34.5" (approx.) x .6875"
Side Track Code: SBST-S (Square)
IS Insert: IS4517
Size: 45mm x 17" (1.77" x 17")
Quantity Shown: 30 total
Finish for all Parts: Natural Satin
Paper Strips Color: A78 Pearl Grey, SWMS45 Paper Inserts
Copy: Helvetica Neue Medium & Regular
Color: Black Laser Printed
Size: .625"
Color: Laser Printed Black

Surround Decorative Outer Framing:
Backer Material: .5" Expanded PVC with Edges Banded
Overall Size of Display: 33.75" (approx.) x 43.375" (approx.) x .5"
Color: PMS 286C Blue

Decorative Top Piece: .040" Aluminum
Finish: Natural Satin Aluminum
Decorative Metal Size: 31.82" (approx) x 42.75" (approx)
"Horseshoe" dimensions as noted, blue areas indicate backer showing through

GSU Logo Size: 2.625"
Color: PMS 286C Blue
Accent Line Color: PMS 186 Red
Copy: Helvetica Neue Medium
Copy Size: .625"
Color: A02 Black

Red Bottom Accent Color: PMS 186 Red (3M-7725-263)
Size: 1.5" x 54.125"

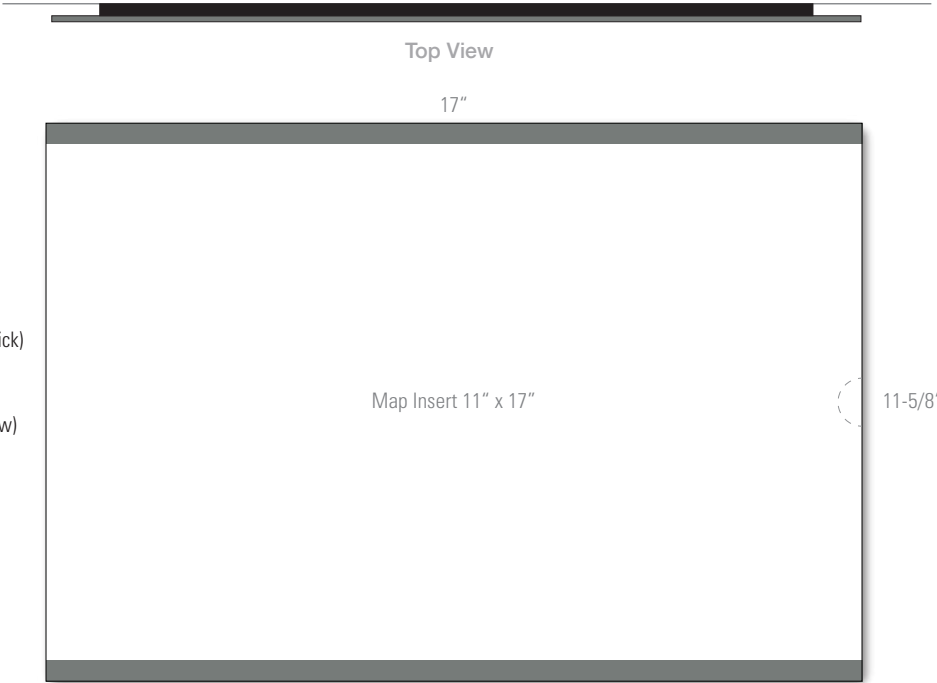
SCALE
1/4" = 1"

SALES REP
Sherry Beauvais
SIGN PLANNING

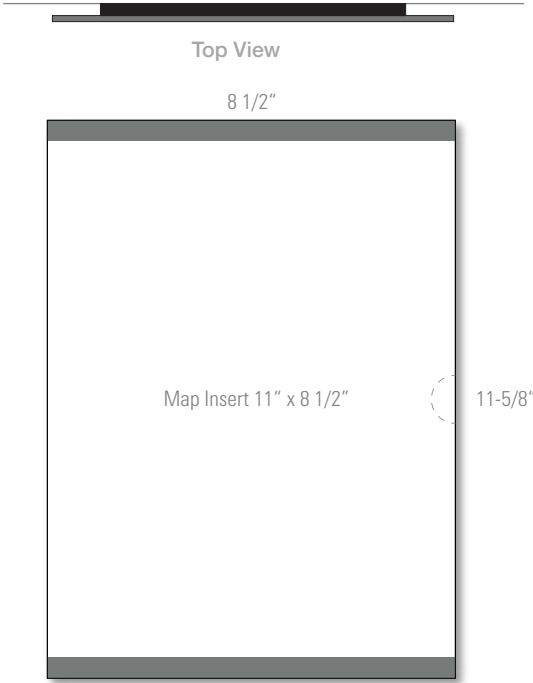
Red Bottom Accent Color: PMS 186 Red (3M-7725-263)
Size: 1.5" x 54.125"



Sign Type E
Evacuation Map Holder
SC Series Elevate EV17
Mounting: Vinyl Tape (VT)
Overall Size:11-5/8" x 17" x 1/8"(thick)
Sintra Backer:
Size: 10-5/8" x 15" x 1/4"
Color: A02 Black
Insert Part Code: EV-WIN (Window)
Paper Size: 11" x 17"
Rule Color: A54 Graphite
Paper Color: A01 White (By others)
Thumb Slot routed into insert



Sign Type E.1
Notice Holder
SC Series Elevate
Mounting: Vinyl Tape (VT)
Overall Size:11-5/8" x 8 1/2" x 1/8"(thick)
Sintra Backer:
Size: 10-5/8" x 6 1/2" x 1/4"
Color: A02 Black
Insert Part Code: EV-WIN (Window)
Paper Size: 11" x 8 1/2"
Rule Color: A54 Graphite
Paper Color: A01 White (By others)
Thumb Slot routed into insert



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Sign Type OH.1

Ceiling Mount Directional

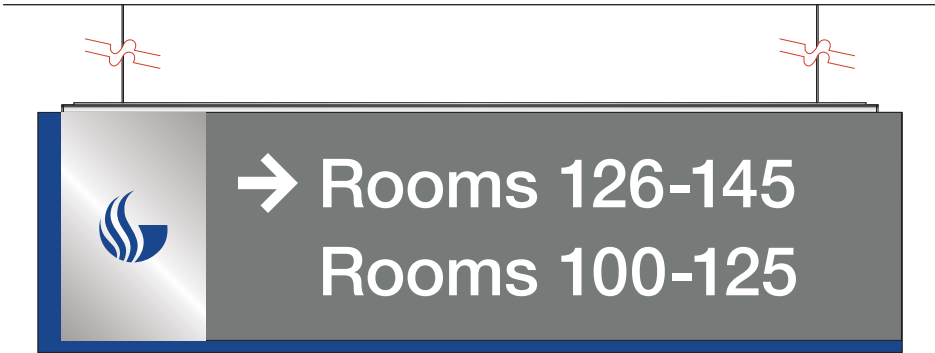
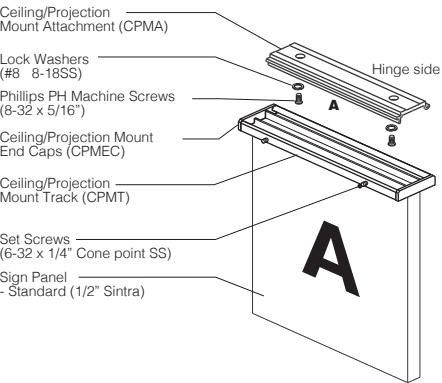
Mounting: Mechanically Fastened
Overall Size as Shown: 10" x 36" x 3/4" Thick

Mounting Hardware Finish: Natural Satin Aluminum
Width: 34"

Graphics Panel Size: 10" x 36" x 1/8"(thick)
Sprayed Panel Color: A54 Graphite
Printed Blue "L" Accent Graphics Size: Vertical 10"x 1",
Horizontal 1/2"x 36"
(placement as shown, verticle accent always on left side
of face)
Color: PMS 286
Printed Copy
Arrow: A110
Size: 2 1/2"
Copy: HelveticaNeue-Medium
Size: 2"
Color: A01 White

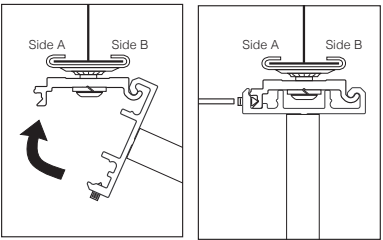
Decorative Aluminum Band Size: 9 1/2" x 6" x .040" thick
Printed Graphics
GSU Flame Size: 3"
Color: PMS 286 Blue

Sintra Core Size: 9" x 34" x 1/2"
Color: A02 Black



Sign Type OH.2 - Suspended Ceiling Mount
Same as OH.1

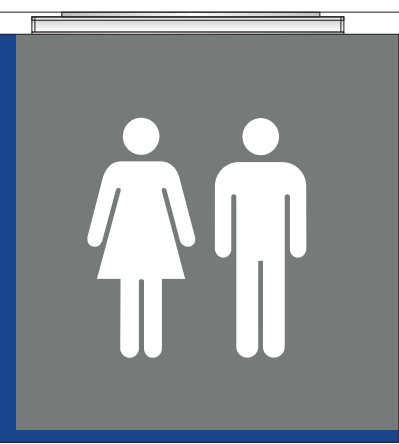
Scale: 1/8" = 1"



Sign Type OH.3 - Soffit Mount

Mounting to wall: To Be Determined
Graphics Panel Size: 10" x 36" x 1/8"(thick)
Sprayed Panel Color: A54 Graphite
Printed Blue "L" Accent Graphics Size: Vertical 10"x 1", Horizontal 1/2"x 36"
(placement as shown, verticle accent always on left side of face)
Color: PMS 286
Printed Copy
Arrow: A110
Size: 2 1/2"
Copy: HelveticaNeue-Medium
Size: 2"
Color: A01 White

Decorative Aluminum Band Size: 9 1/2" x 6" x .040" thick
Printed Graphics
GSU Flame Size: 3"
Color: PMS 286 Blue



Sign Type OH.4

Overhead Wall Mount ID

Mounting: Mechanically Fastened
Overall Size: 8 1/2" x 8 1/2" x 3/4" Thick

Mounting Hardware Finish: Natural Satin Aluminum
Length: 6 1/2"

Graphics Panel Size: 8 1/2" x 8 1/2" x 1/8"(thick)
Sprayed Panel Color: A54 Graphite
Printed Graphics
Blue "L" Accent Size:
Vertical 8 1/2"x 1/2", Horizontal 1/4"x 8 1/2"
(placement as shown, verticle accent
towards wall always)
Color: PMS 286
Symbol: As noted in message schedule
Size: 5"
Color: A01 White

Sintra Core Size: 6 1/2" x 8" x 1/2"
Color: A02 Black

Scale: 1/8" = 1"



Sign Type PWM
Projection Wall Mount ID

Mounting: Mechanically Fastened
Overall Size: 8 1/2" x 8 1/2" x 3/4" Thick

Mounting Hardware Finish: Natural Satin Aluminum
Height: 6 1/2"

Graphics Panel Size: 8 1/2" x 8 1/2" x 1/8"(thick)
Sprayed Panel Color: A54 Graphite
Printed Graphics
Blue "L" Accent Size:
Vertical 8 1/2" x 1/2", Horizontal 1/4"x 8 1/2"
(placement as shown, verticle accent
towards wall always)
Color: PMS 286
Symbol: As noted in message schedule
Size: 5"
Color: A01 White

Format: CC Symbols in Grey area

Sintra Core Size: 6 1/2" x 8" x 1/2"
Color: A02 Black

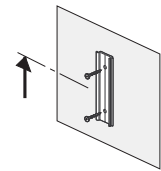


Fig. 1

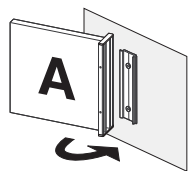


Fig. 2

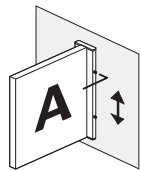
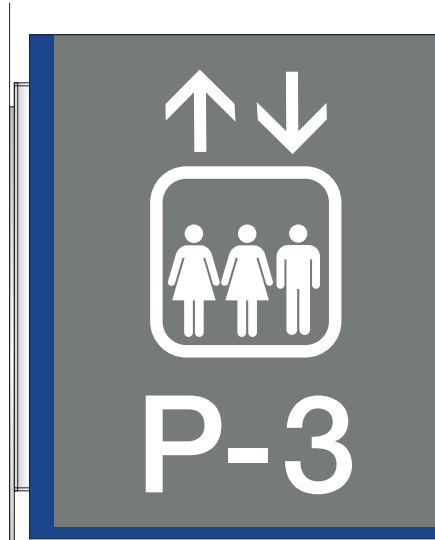
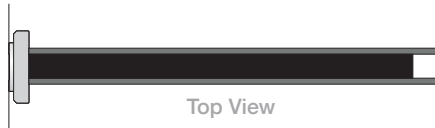


Fig. 3



Sign Type PWM.1
Projection Wall Mount ID

Mounting: Mechanically Fastened
Overall Size: 10 1/2" x 8 1/2" x 3/4" Thick

Mounting Hardware Finish: Natural Satin Aluminum
Height: 9 1/2"

Graphics Panel Size: 10 1/2" x 8 1/2" x 1/8"(thick)
Sprayed Panel Color: A54 Graphite
Printed Graphics
Blue "L" Accent Size:
Vertical 14"x 1/2", Horizontal 1/4"x 8 1/2"
(placement as shown, verticle accent
towards wall always)
Color: PMS 286
Symbol: As noted in message schedule
Size: 6"
Copy: Helvetica Neue Medium
Size: 2"
Color: A01 White

Format: CC Symbols in Grey area

Sintra Core Size: 10 1/2" x 8" x 1/2"
Color: A02 Black

Design Concepts

SCALE
1/4" = 1"

SALES REP
Sherry Beauvais

SIGN PLANNING

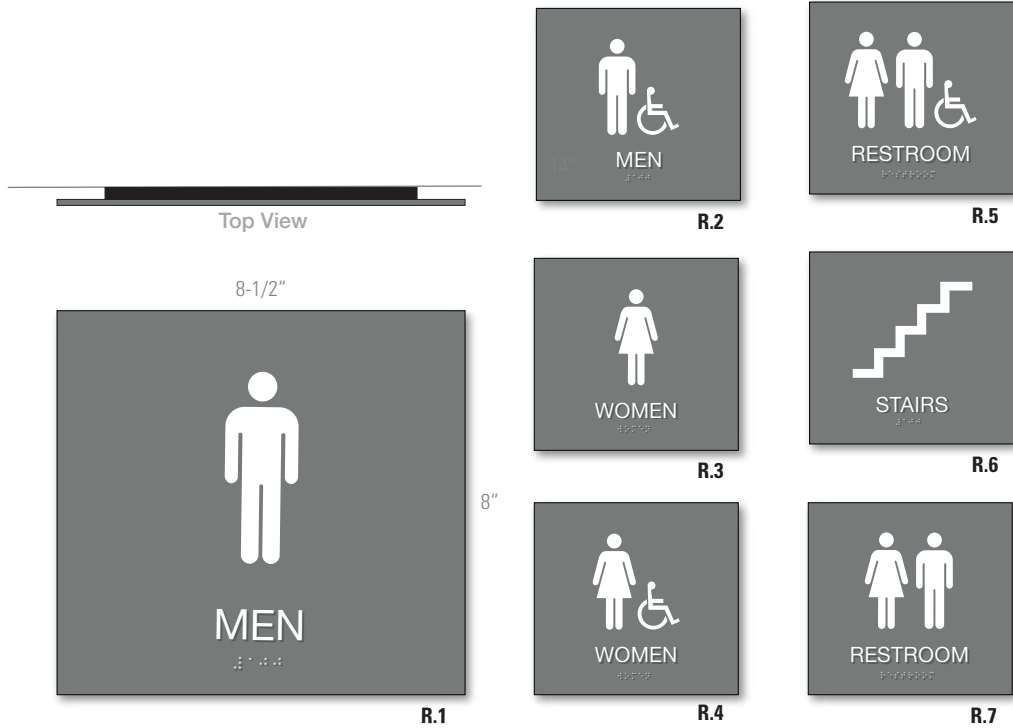
WO #

DATE APPROVED

APPROV. BY

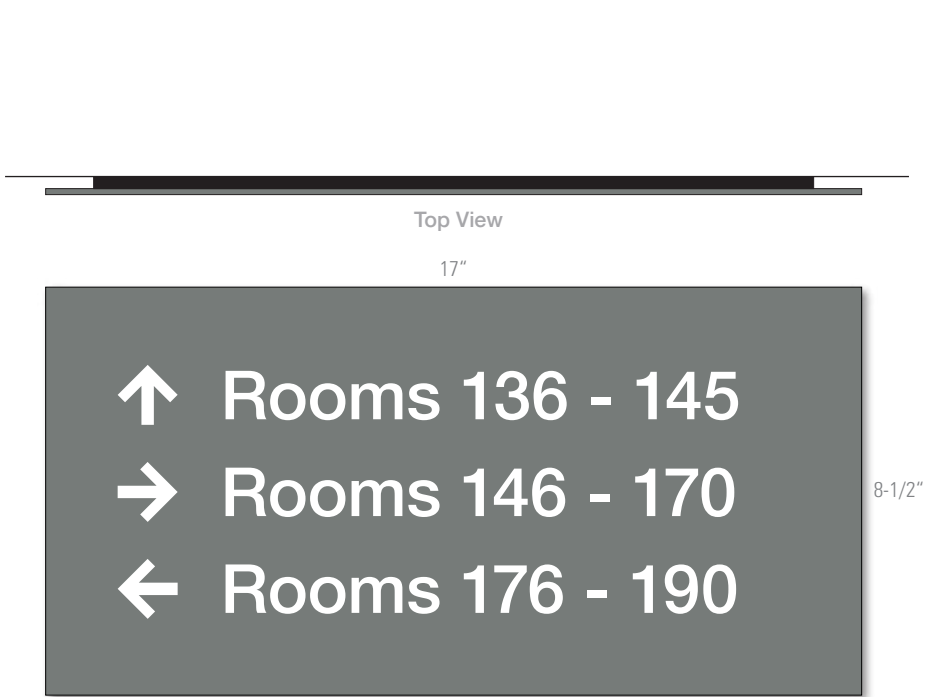
DATE

PHASE
Final R9 - PLH



Sign Types R.1 - R.7

Regulatory Sign
SC Series Elevate EV85
Overall Size: 8" x 8 1/2"
Mounting: Vinyl Tape (VT)
Sintra Backer:
Size: 7" x 6-1/2" x 1/4"
Color: A02 Black
Part Code: EV-341A-DPT-8085(ADA)
Size: 8" x 8 1/2" x 1/8"(thick)
Color: A54 Graphite
Printed Graphics Application
Symbol: Per Message Schedule
Size: 4"
Nursery Symbol Size: 1 3/4"
Color: A01 White
Raised Graphics Application: Direct Print (DPT)
Copy: HelveticaNeue-Roman (HR)
Size: 5/8"
Color: A01 White
Braille Color: Same as background



Sign Type WF.1

Wayfinding Directional Sign – Small

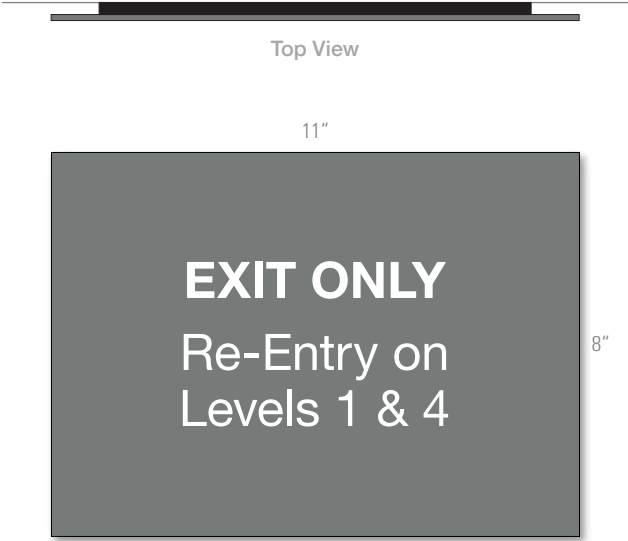
SC Series Elevate EV17
Overall Size: 8-1/2" x 17"
Mounting: Vinyl Tape (VT)

Sintra Backer:
Size: 7-1/2" x 15" x 1/4"
Color: A02 Black

Part Code: EV-341A
Size: 8-1/2" x 17" x 1/8"(thick)
Color: A54 Graphite
Printed Graphics
Copy: Helvetica Neue Medium
Size: 1"
Color: A01 White
Arrow: A110
Size: 1 1/4"
Color: A01 White



Sign Type S.1
Elevator Warning Sign
SC Series Elevate EV11
Overall Size: 8" x 11"
Mounting: Vinyl Tape (VT)
Sintra Backer:
Size: 7" x 9" x 1/4"
Color: A02 Black
Part Code: EV-341A
Size: 8" x 11" x 1/8"(thick)
Color: A54 Graphite
Printed Graphics
Symbol: F7
Size: 3 1/2"
Copy: HelveticaNeue-Roman (HR)
Size: 5/8"
Color: A01 White



Sign Type S.2
Information ID
SC Series Elevate EV11
Overall Size: 8" x 11"
Mounting: Vinyl Tape (VT)
Sintra Backer:
Size: 7" x 9" x 1/4"
Color: A02 Black
Part Code: EV-341A
Size: 8" x 11" x 1/8"(thick)
Color: A54 Graphite
Printed Graphics
Copy: HelveticaNeue-Roman (HR)
Copy: HelveticaNeue-Bold (HN65)
Size: 3/4"
Color: A01 White



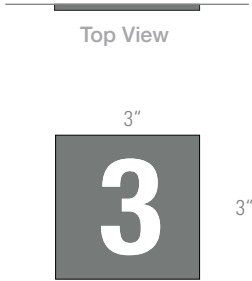
Sign Type S.3
Life Safety Information
SC Series Elevate EV11
Overall Size: 8" x 11"
Mounting: Vinyl Tape (VT)
SC Series Elevate EV85 (No Reveal)
Mounting: Vinyl Tape (VT)
Sintra Backer:
Size: 2" x 4" x 1/4"
Color: A02 Black
Part Code: EV-341A-DPT
Color: A54 Graphite
Direct Print Tactile Graphics (DPT)
Copy: HelveticaNeue-Roman (HR)
Size: 3/4"
Color: A01 White
Braille Color: Same as background



Sign Type S.4
Stairwell Exit Discharge
341A Series
Overall Size: 18" x 14"
Mounting: Vinyl Tape (VT)
Part Code: 341A
Color: A54 Graphite
Printed Graphics
HelveticaNeueCondensed-Bold (HNCB)
Size: 1 1/2"
HelveticaNeue-Bold (HM)
Size: 5"
HelveticaNeue-Heavy (HN85)
Size: 1"
Arrow: A120
Size: 1 1/4"
Color: A01 White



Sign Type S.5
Life Safety Information
341A Series
Overall Size: 3" x 11"
Mounting: Vinyl Tape (VT)
Part Code: 341A
Color: A54 Graphite
Printed Graphics
Copy: HelveticaNeue-Roman (HR)
Size: 5/8"
Color: A01 White







Sign Type S.6
Elevator Label-Life Safety
341A Series
Overall Size: 3" x 3"
Mounting: Vinyl Tape (VT)
Part Code: 341A
Color: A54 Graphite
Printed Graphics
Copy: HelveticaNeueCondensed-Bold (HNCB)
Size: 2"
Color: A01 White











Appendix B - Exterior Signage

PAINT SCHEDULE

	P1 Dupont BS500 Low Gloss Blue
	P2 Matthews 41342 Brushed Aluminum, Matthews Acrylic Polyurethane Finish
	P3 Matthews 33764 Black Indigo
	P4 Dupont RS907 Low Gloss Red

VINYL SCHEDULE

	V1 Oracal 951-546 Velvet Blue
	V2 Oracal 951-010 White
	V3 Oracal 951-070 Black
	V4 Oracal 951-028 Cardinal Red
	V5 Oracal 8300-049 King Blue - Transparent
	V6 Oracal 8300-031 Red - Transparent
	V7 3M 5100-R-10 White Reflective
	V8 3M 3635-222 Dual-Color Film, painted P1 on black side

1 Finishes

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 0123456789

TYPEFACE 1 - Avenir 55 Roman

2 Typefaces

GENERAL NOTES

- ALL INSTALLATION/MOUNTING TO COMPLY WITH LOCAL ORDINANCE/ADA.

TYPICAL NOTES

- REFER TO DRAWING NOTES FOR MATERIAL THICKNESS AND/OR DIAMETER UNLESS SPECIFICALLY NOTED IN THE FINISH SCHEDULE.

ASSEMBLY SPECIFICATIONS

- ALL HARDWARE TO BE SECURED WITH LOCTITE OR EQUIVALENT TO DETER VANDALISM.

FABRICATION SPECIFICATIONS

- SEAMLESS CONSTRUCTION; ALL SEAMS/WELDS TO BE FILLED, GROUND, SANDED, AND FINISHED SMOOTH.
- NO VISIBLE FASTENERS UNLESS THEY ARE SPECIFICALLY PART OF DESIGN INTENT.

3 General Notes

GEORGIA STATE UNIVERSITY

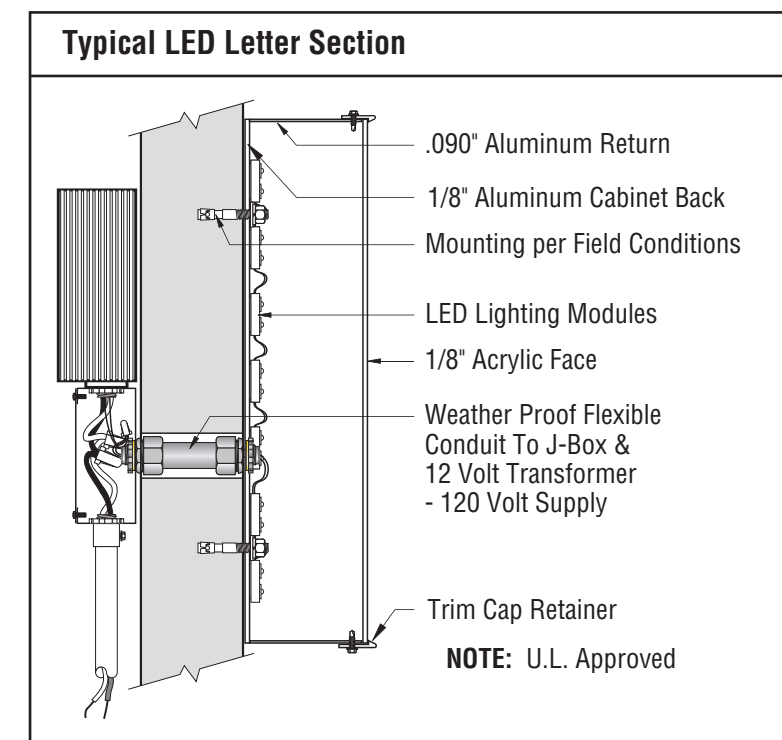


4 Logos



2 Front View

SPECIFICATIONS	
MATERIALS:	
A	- 8" deep fabricated aluminum channel letters with internal LED illumination, translucent white acrylic face and first surface applied vinyl (V8). Returns painted P1.
B	- 8" deep fabricated aluminum channel letters with internal LED illumination, translucent white acrylic face and first surface applied vinyl (V6). Returns are painted (P4) red.
INSTALL:	
<ul style="list-style-type: none"> - All structural components to be verified by engineer. - All installation/mounting to comply with local ordinances 	
NOTES:	
<ol style="list-style-type: none"> 1. Fabricator to field verify all conditions for final production and engineering. 2. Purpose of dual-color film allows for sign to appear blue during the day and glow white at night. 3. Trimcaps to be painted to match returns. 	



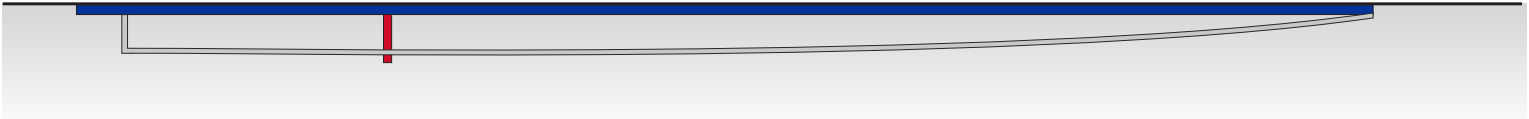
3 Section Detail



1 Building Address – Detail



2 Building Address – Finish Detail



3 Building Address – Plan View

SPECIFICATIONS

MATERIALS:

- A - Fabricated aluminum cabinet, P1
- B - 1/2" thick rolled aluminum with routed logo, P2
- C - Fabricated aluminum cabinet, P4
- D - Copy etched into aluminum panel, P3

INSTALL:

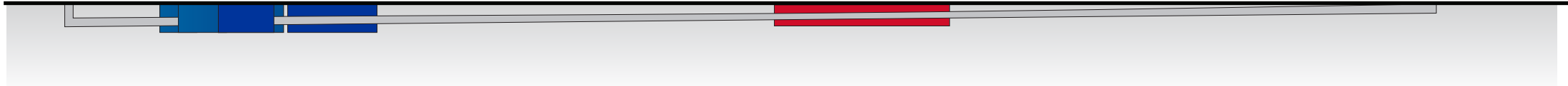
- All structural components to be verified by engineer.

NOTES:

1. Fabricator to field verify all conditions for final production and engineering.
2. It is the responsibility of the fabricator to ensure that all penetrations into all concrete and/or precast columns and beams do not affect the structural integrity of the steel reinforcement within.
3. All seams, joints and welds to be filled, ground/sanded, and finished smooth.



1 University ID - Detail



2 University ID - Plan View

SPECIFICATIONS

MATERIALS:

- A - Fabricated aluminum channel letter, P1
- B - Fabricated aluminum cabinet, P2
- C - Copy etched into aluminum panel, P3
- D - Fabricated aluminum cabinet, P4

INSTALL:

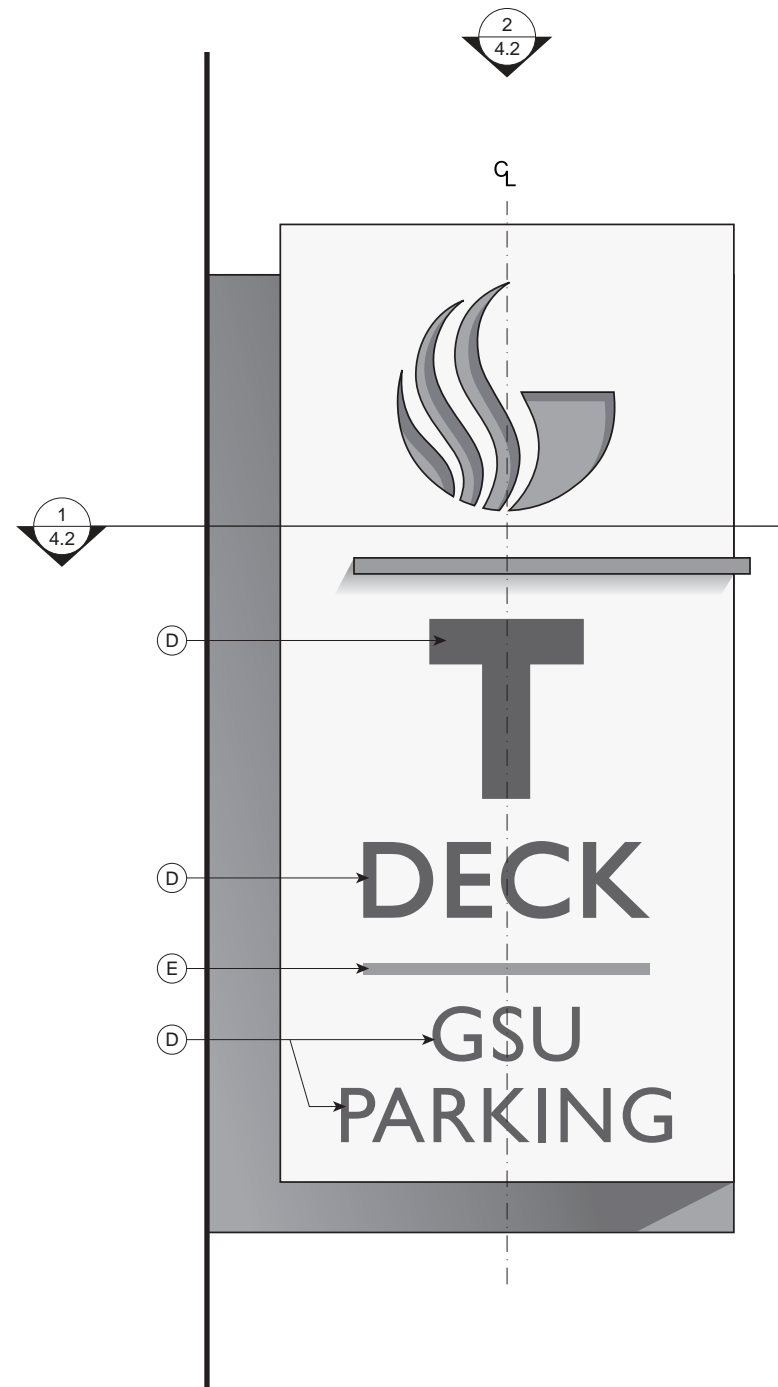
- All structural components to be verified by engineer.

NOTES:

1. Fabricator to field verify all conditions for final production and engineering.
2. It is the responsibility of the fabricator to ensure that all penetrations into all concrete and/or precast columns and beams do not affect the structural integrity of the steel reinforcement within.
3. All seams, joints and welds to be filled, ground/sanded, and finished smooth.



1 Side Elevation
SCALE: 1/2"=1'-0"



2 Front Elevation - Detail
SCALE: 1/2"=1'-0"

SPECIFICATIONS

MATERIALS:

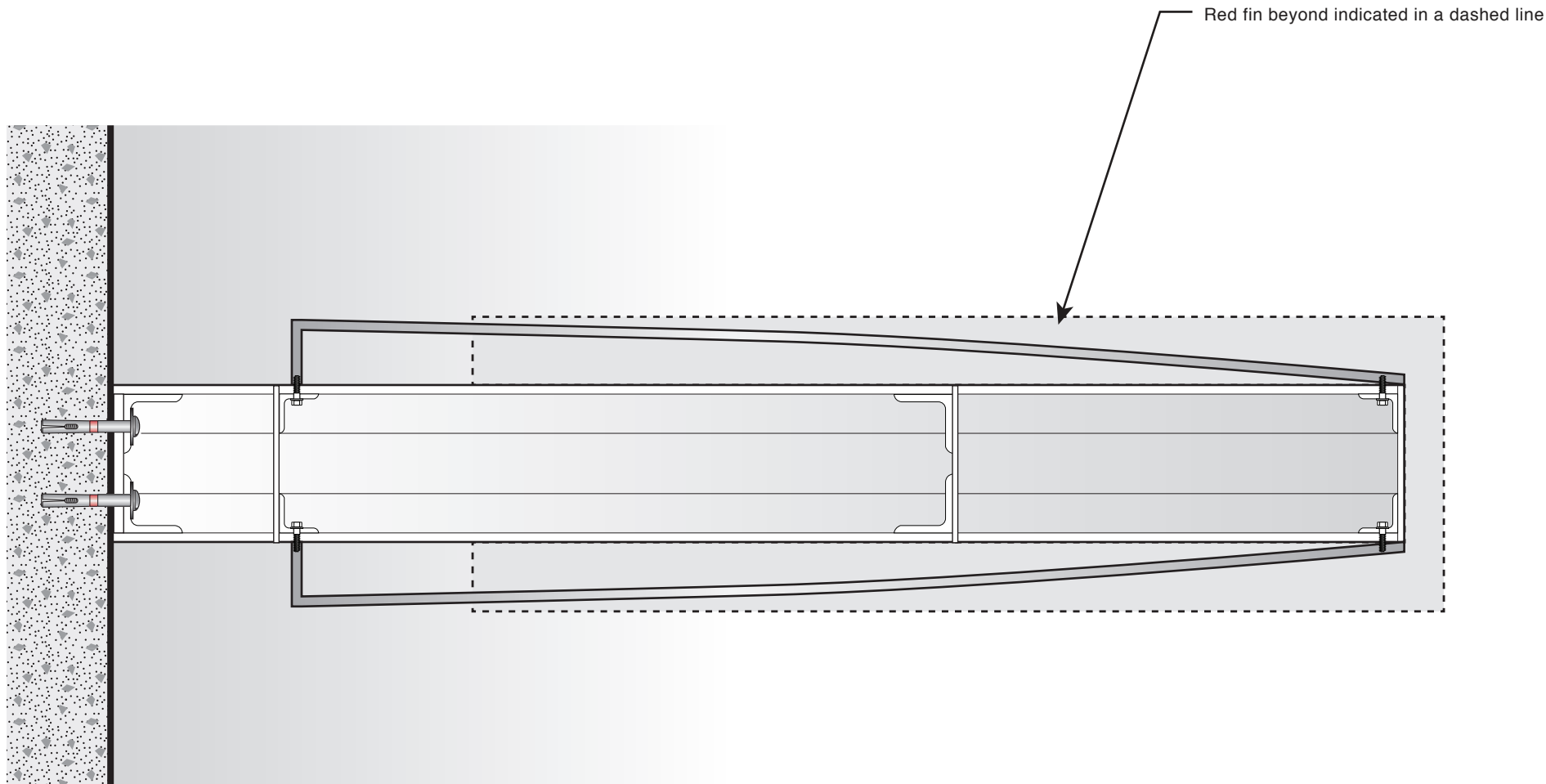
- A - Fabricated aluminum cabinet, P1.
- B - 1/2" thick curved aluminum panel painted P2 with routed "G" logo. D Copy etched into aluminum panel, P3, P4.
- C - 2" fabricated aluminum fin, P4.
- D - P3
- E - P4

INSTALL:

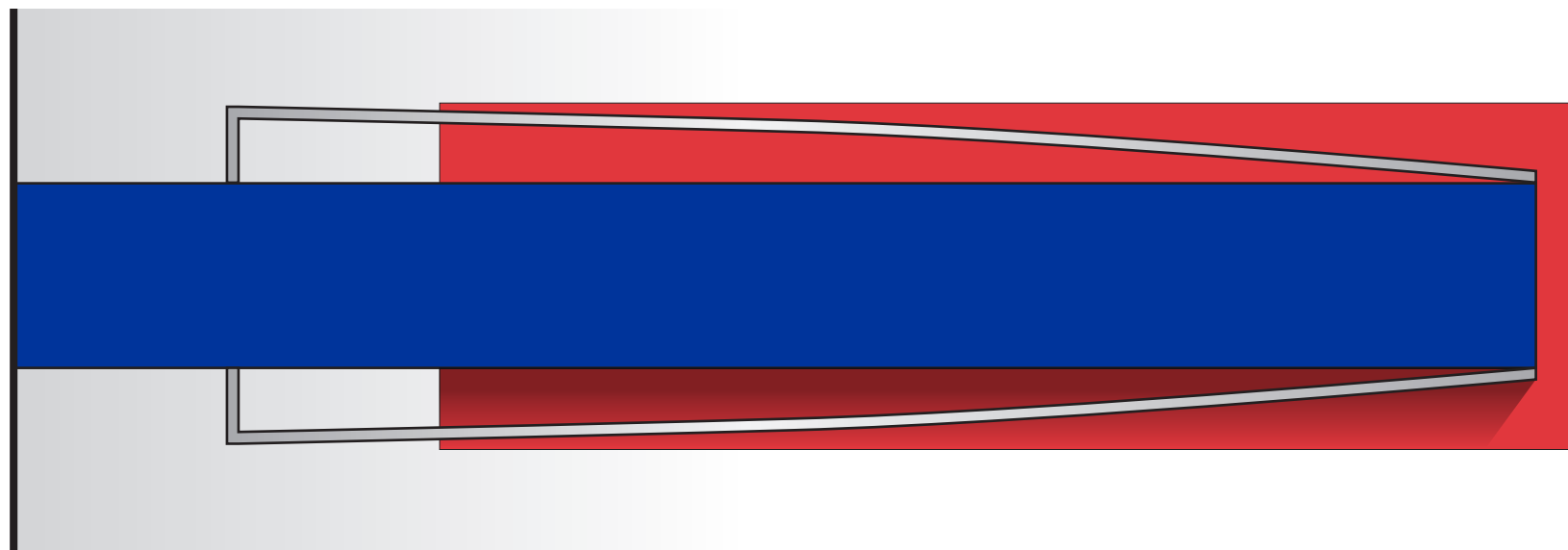
- All structural components to be verified by engineer.

NOTES:

1. Fabricator to field verify all conditions for final production and engineering.
2. **SIGN IS DOUBLE-SIDED.**
3. It is the responsibility of the fabricator to ensure that all penetrations into all concrete and/or precast columns and beams do not affect the structural integrity of the steel reinforcement within.
4. All seams, joints and welds to be filled, ground/sanded, and finished smooth.
5. Provide internal framing as needed to prevent oil canning.



1 SECTION



2 PLAN VIEW

SPECIFICATIONS

MATERIALS:

- A - Fabricated aluminum cabinet, P1.
- B - 1/2" thick curved aluminum panel painted P2 with routed "G" logo. D Copy etched into aluminum panel, P3, P4.
- C - 2" fabricated aluminum fin, P4.
- D - P3
- E - P4

INSTALL:

- All structural components to be verified by engineer.

NOTES:

1. Fabricator to field verify all conditions for final production and engineering.
2. **SIGN IS DOUBLE-SIDED.**
3. It is the responsibility of the fabricator to ensure that all penetrations into all concrete and/or precast columns and beams do not affect the structural integrity of the steel reinforcement within.
4. All seams, joints and welds to be filled, ground/sanded, and finished smooth.
5. Provide internal framing as needed to prevent oil canning.

Appendix C



IIT Network Design Standard

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SECTION 27-00-00

SECTION 27-00-00
COMMUNICATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 01 General Requirements shall be considered a part of this section and shall have the same force as if printed herein full.

1.02 QUALITY ASSURANCE

- A. Specifications, Standards and Codes

All work shall be in accordance with the following:

1. The 2014 edition of the National Electrical Code (NFPA 70).
2. The 2012 edition of the Standard Building Code.
3. The 2015 edition of the Life Safety Code (NFPA 101).
4. The National Electrical Safety Code (ANSI C-2).
5. National Electrical Manufacturers Association (NEMA)
6. Telecommunications Industries Association (TIA)
7. Electronic Industries Association (EIA)
8. National Electrical Safety Code (NESC)
9. Institute of Electrical & Electronics Engineers (IEEE)
10. Underwriters Laboratories (UL)
11. American Standards Association (ASA)
12. Federal Communications Commission (FCC)
13. Occupational Safety and Health Administration (OSHA)
14. American Society of Testing Material (ASTM)
15. Americans with Disabilities Act (ADA)
16. Local city and county ordinances governing electrical work.

*In the event of conflicts, the more stringent provisions shall apply.

1.03 SCOPE

- A. The work to be done under this Section of the Specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.
- B. All materials, a part of the Telecommunications Infrastructures and necessary to its

SECTION 27-00-00

proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

- C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the engineer shall be notified of the discrepancy.

1.04 WORK INCLUDED

The Communications Infrastructures installed, and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:

- A. Voice/Data Cabling Infrastructure
- B. Telecommunications conduits, raceways, cable tray, racks, cabinets and equipment mounting boards as indicated on the Drawings.
- C. Grounding and Bonding
- D. Underground raceway excavation, backfill, and compaction.
- E. Concrete work for duct banks, manholes, hand-holes, vaults and restoration (where applicable).
- F. CATV Cabling Infrastructure and Distribution System

1.05 DEFINITIONS

- A. Terms: The following definitions of terms supplement those of the GENERAL REQUIREMENTS and are applicable to DIVISION 27 - COMMUNICATIONS.
 - 1. Provide: As used herein shall mean "furnish, install and test (if applicable) complete".
 - 2. Infrastructure: As used herein shall mean "cable, installed in conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed."
 - 3. Work: As used herein shall be understood to mean the materials completely installed, including the labor involved.

1.06 DRAWINGS

SECTION 27-00-00

- A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.
- B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop Drawings, equipment location Drawings, foundation Drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.
- C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.
- D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.
- E. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Engineer.
- F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.
- G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Technology plans.
- H. Schematic diagrams shown on the Drawings indicate the required functions only.

The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Contractor's expense.
- I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.

SECTION 27-00-00

- J. Review all architectural Drawings for modular furniture.
- K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "shall be", "as indicated on the Drawings", "In accordance with", "a", "the" and "all are intended" shall be supplied by inference.

1.07 SUBMITTALS

- A. Submit for approval, details of all materials, equipment and systems to be furnished. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items. Three (3) copies of the following shall be submitted:
 - 1. Submittals for individual systems and equipment assemblies that consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered, reviewed or stored, and such submittals will not be returned except at the request and expense of the Contractor.
 - 2. Contractor shall generate shop Drawings. Modify reviewed and accepted shop Drawings to include revisions based upon completion of work. Submit shop Drawings with record Drawings on hard copy. Shop Drawings shall include equipment racks, patch panels, termination blocks, connection details, rack mounting details and any other details not included in the construction Drawings.
- B. Any materials and equipment listed that are not in accordance with specification requirements may be rejected.
- C. The approval of material, equipment, systems and shop Drawings is a general approval subject to the contract Drawings, Specifications and verification of all measurements at the job. Approval does not relieve the Contractor from the responsibility of shop drawing errors. The Contractor shall carefully check and correct all shop Drawings prior to submission for approval.
- D. Submittals for each section shall vary.

1.08 QUALITY ASSURANCE

- A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

SECTION 27-00-00

- B. Equipment shall bear labels attesting to Underwriters Laboratories or certification by other recognized laboratory, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

1.09 CONTRACTOR QUALIFICATIONS

- A. The Telecommunications / Networking contractor must be an approved Ortronics (Legrand) Certified Contractor at a Plus tier (CIP, or CIP-ESP tier) and able to provide nCompass Warranty. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications / Networking contractor is responsible for workmanship and installation practices in accordance with all manufacturer guidelines. Ortronics/Superior Essex (nCompass) will extend a Limited Lifetime or 25 year warranty to the End User for projects completed upon receipt of test results.
- B. The Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Contractor shall be a company specializing in the design, fabrication and installation of integrated telecommunications systems.
- C. Telecommunications Systems specified shall be installed under the direction of a qualified Contractor. Qualification requirements shall include submittal by the Contractor to the Architect of the following:
 - 1. List of previous projects of this scope, size and nature, including names and sizes of projects, description of work, times of completion and names of contact persons for reference.
 - 2. Contractor shall be certified by Superior Essex / Ortronics to provide warranty for the copper cabling system.
 - 3. Contractor shall provide documentation of certification.
 - 4. Contractor shall be licensed by the State of Georgia as a low voltage contractor.
 - 5. Contractor shall be certified by Electronics Technician Association Fiber Optic Installer, or Corning NPI (Network of Preferred Installers, or BICSI Installer 2 in fiber optics installation.
 - 6. Contractor shall provide documentation of certification.

SECTION 27-00-00

1.10 COORDINATION WITH OTHER TRADES

- A. The Contractor shall coordinate telecommunications work with that of other Sections as required to ensure that the entire telecommunications work will be carried out in an orderly, complete and coordinated fashion.

1.11 SITE INVESTIGATION

- A. Prior to submitting bids of the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems, shall be restored to their original condition before the completion of this project.

1.12 PERMITS

- A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

1.13 RENOVATIONS AND ADDITIONS

- A. All work that would adversely affect the normal operation of the other portions of the Owner's property shall be done at a time other than normal working hours. Normal working hours shall be considered eight (8:30) a.m. to five (5:15) p.m. Monday through Friday.
- B. Prior to submitting bids on the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project.
- C. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems shall be restored to their original and operating condition. Remove all equipment indicated to be demolished, including outlets, devices, raceways and support structures.
- D. Care shall be exercised in the removal and storage of equipment indicated to be relocated or removed and reused. Prior to placing back into service, equipment shall be cleaned, and marred or chipped paint surfaces touched-up.
- E. Provide all coring, cutting and patching to existing walls, floors, etc., required for the removal of existing work or the installation of new work.

SECTION 27-00-00

1.14 TELECOMMUNICATIONS ROOM SIZES

- A. Telecommunications rooms (TR) shall meet or exceed the following size requirements:
 - 1. Telecommunications rooms shall be sized for N+1 racks where N is the number of racks required to house all equipment specified for existing and new services. Therefore, minimum closet size shall accommodate at least two racks.
 - 2. Rooms equipped with two (2) equipment racks shall be 10' x 9'.
 - 3. Rooms equipped with three (3) equipment racks shall be 12'x 9'.
 - 4. Rooms equipped with two (4) equipment racks shall be 15 x 9'.
 - 5. Rooms equipped with more than (4) equipment racks shall be custom designed to accommodate the specific requirements of the site.

PART 2 - PRODUCTS

2.01 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.

2.02 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

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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

3.01 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.

3.02 PROTECTION OF SYSTEMS AND EQUIPMENT

- A. Protect materials and equipment from damage during storage at the site and

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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.

3.03 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.

3.04 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.

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

3.05 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.

3.06 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.

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- 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 27-05-10

FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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.

1.02 SUBMITTALS

- A. Product data: Manufacturer's specifications and technical data including the following:
 - 1 Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.

1.03 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 Firestopping Materials.

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PART 2 - PRODUCTS

2.01 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.)

2.02 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:
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.

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- 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 use 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.

2.03 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:

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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
3. Smooth Firestop System
 - a. Block Wall - W-J-3048
 - b. Dry Wall - W-L-3137
4. Split-Sleeve Firestop System
 - a. Block Wall - W-J-3047
 - b. Dry Wall - W-L-3136

2.04 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 have 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

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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

3.01 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.

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3.02 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.

3.03 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.

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3.04 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.

3.05 CLEANING

- F. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
- G. Leave finished work in a neat and clean condition with no evidence of spill overs or damage to adjacent surfaces.

3.06 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-05-26

GROUNDING & BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Grounding & Bonding for Communications Systems.
- 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.

1.02 SUBMITTALS

- A. Provide product data.

1.03 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 Grounding Conductors.
 - 2. Furnish and install all Grounding Lugs and Hardware.
 - 3. Furnish and install all Grounding Busbars.

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PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Grounding Conductor manufacturer(s):

1. Southwire
2. Or Approved Equal

B. Approved Grounding Lug manufacturer(s):

1. Burndy
2. Thomas & Betts
3. Or Approved Equal

C. Approved Grounding Busbar manufacturer(s):

1. Chatsworth Products, Inc.
2. B-Line
3. Legrand

2.02 GROUNDING CONDUCTORS

A. Grounding Conductor

1. Construction shall be Type THHN copper conductors, insulated with heat and moisture resistant PVC over which a UL listed jacket is applied.
2. Jacket color shall be green or black. Black jacketed cable shall be identified at each termination point with a wrap of green tape.

2.03 GROUNDING LUGS

A. Grounding Lugs and Hardware

1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the crimper impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless-steel bolts and washers shall be used to

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install lugs to equipment. Exothermic welding is also allowed.

2.04 Grounding Busbar

1. The grounding busbar shall be made of 1/4" thick solid copper.
2. The grounding busbar shall be installed with minimum clearance, 1" offsets and 1-1/2" insulators.
3. The grounding busbar shall accommodate 2-hole compression lugs.
4. The grounding busbar shall meet or exceed ANSI/TIA-607-C requirements.

PART 3 - EXECUTION

3.01 GROUNDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607-C Telecommunications Bonding and Grounding Standard.
- B. The main entrance facility/equipment room in each building shall be equipped with a Primary Bonding Busbar (PBB) formerly called the telecommunications main grounding busbar (TMGB). Each telecommunications room shall be provided with a Secondary Bonding Busbar (SBB) formerly called the telecommunications ground busbar (TGB). The PBB shall be connected to the building electrical entrance grounding facility.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MC/IC/TC shall be grounded to the respective SBB or PBB using a minimum #6 AWG stranded copper bonding conductor and compression lugs.
- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA-606-B.

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- E. See Section 27 05 43 for underground duct and raceway systems ground requirements.

3.02 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-05-28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full. Adhere to requirements called out in ANSI/TIA-569-D (Telecommunications Pathways and Spaces).
- B. This document describes the products and execution requirements relating to Pathways for Communications Systems.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of interior telecommunications pathways 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.

1.02 SUBMITTALS

- A. Provide product data.

1.03 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 complete Conduit System.
 - 2. Furnish and install all Telecommunications Outlet Boxes.

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3. Furnish and install all Pull Boxes.
4. Furnish and install complete Cable Tray System.
5. Furnish and install all Cable Hangers.
6. Furnish and install all Velcro Straps.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

- A. Rigid/Intermediate Conduit manufacturer(s)
 1. Allied
 2. Triangle
 3. Wheatland
 4. Youngstown
- B. Non-Metallic (PVC) manufacturer(s):
 1. Carlon
 2. Georgia Pipe Company
 3. Or Approved Equal
- C. Electrical Metallic Tubing (EMT) manufacturer(s):
 1. Allied
 2. Triangle
 3. Wheatland
 4. Youngstown
- D. EMT Fittings manufacturer(s):
 1. Thomas & Betts
 2. Steel City
 3. Or Approved Equal

1.	Endot Industries	Part Numbers 2" non-plenum – 1050 1-1/4" non-plenum – 1250 1" non-plenum – 2000 1-1/4 plenum – PL/1250
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1. Steel City
2. Raco
3. Or Approved Equal

1. Hoffman
2. Legrand
3. Or Approved Equal

1. Legrand
2. Flex Tray
3. Wiremold
4. EZ Tray
5. B-Line

1. Erico Products – Caddy
Part Numbers: J-Hook/Sling CABLECAT
Bridle Ring 4BRT-20
Bridle Ring Bracket 4-TIB
2. Cablofil Legrand

1. Panduit
2. Or Approved Equal

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2.02 CONDUIT

A. Rigid and Intermediate Conduit

1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.

B. Non-Metallic (PVC) Conduit

1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC.
2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

C. Electrical Metallic Tubing (EMT)

1. Electrical metallic tubing (EMT), couplings and connectors shall be steel. Malleable iron, pressure-cast or die-cast fittings are not permitted.
2. Fittings for 2" EMT and smaller shall be steel set screw type, except where otherwise noted. Fittings for 2.5" and larger shall be steel set screw type with two (2) screws for connectors and four (4) screws for couplings. All connectors shall be insulated throat type.

D. Conduit Support

1. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2 inch and smaller with 1/4-inch threaded steel rods and use 3/8 inch rods for 2 inch and larger.
2. Conduit support channels shall be 14 gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension shall be 3/8" threaded steel rods. Attach suspension rods to structure with swivel type connectors. Conduit straps shall be spring steel type compatible with channel.
3. Conduit straps shall be single hole cast metal type or two-hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

E. Innerduct

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1. Exposed innerduct shall be rated CMP (plenum), corrugated plastic equipped with pull-string or mule tape.
2. Sizes shall be 2", 1-1/4" & 1" inside diameter.

2.03 METALLIC TELECOMMUNICATIONS OUTLET BOXES

- A. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16" thick.
- B. The dimensions of the metallic outlet box shall be 4" x 4" square with a minimum depth of 2-1/8".
- C. Metallic outlet boxes shall be equipped with single device covers (or two-device covers where needed). Where installed in plaster, gypsum board, etc., covers shall be raised to compensate for the thickness of the wall finish.
- D. Where metallic outlet boxes are to be empty for future use, blank coverplates shall be used.

2.05 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.

2.06 CABLE TRAY

- A. Cable Tray System
 1. Cable tray shall be steel or aluminum construction.
 2. Cable tray cross members shall be factory welded at 12" intervals maximum.
 3. Cable tray shall be equipped with one (1) or two (2) support rails that run the length of each segment.

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4. End caps shall be installed on the exposed ends of the cable tray, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
5. Wall mount cable tray used in limited clearance areas shall be hook style and constructed of aluminum.
6. Cable Tray color shall be gray.

2.07 CABLE HANGERS

A. J-Hooks

1. J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables. J-hook shall be cULus Listed.
2. J-hooks shall have flared edges to prevent damage while installing cables.
3. J-hooks sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

B. Adjustable Non-Continuous Cable Support Sling

1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425, 4-pair, balanced twisted pair; rated for indoor use in non-corrosive environments. Rated to support Category 5e and higher cable, or optical fiber cable. Cable support sling shall be cULus Listed.
2. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.

C. Bridle Rings

1. Bridle rings shall be made of steel, rated for indoor use in non-corrosive environments.
2. Bridle rings shall be UL listed.
3. Shall have an ultimate static load limit of 50 lbs. depending on application, select threaded, unthreaded or wood screw variety.

2.08 VELCRO STRAPS

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A. Velcro Straps

1. Cables shall be fastened to support structures with Velcro straps.
2. Velcro straps installed in air handling spaces must be plenum rated.
 - a. Plenum Velcro strap color shall be red.

PART 3 - EXECUTION

3.01 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 continuous conduit is not used shall be sleeved with a section of EMT conduit of appropriate diameter to accommodate all cable and firestopping materials, and shall extend at least one inch beyond both sides of the penetration.
- F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.02 CONDUIT SYSTEM

- A. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.
- B. Leave all empty conduits with a 200-pound test nylon cord pull line.
- C. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

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- D. 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.
- E. 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.
- F. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.
- G. 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.
- H. Where conduits must pass through structural members obtain approval of Architect.
- I. 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.
- J. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
- K. 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.
- L. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete.
- M. Conduit Installations Within Slab/Floor

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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.) or Schedule 40, heavy wall PVC.
- N. Telecommunications cables shall not occupy conduits with power cables.
- O. Metallic conduits shall be grounded in accordance with ANSI/TIA-607-C.
- P. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.
- Q. Conduit runs shall not have more than two (2) 90-degree bends between pull points.
- R. Telecommunications conduit system shall contain no conduits (also known as an LB).
- S. 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

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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.

2. Each horizontal home-run conduit can serve from one (1) to three (3) outlet boxes. For one (1) outlet box, a 3/4" conduit shall be used, minimum. For two (2) outlet boxes, a 1" conduit shall be used, minimum. For three (3) outlet boxes, a 1-1/4" conduit shall be used, minimum.

3.03 TELECOMMUNICATIONS OUTLET BOXES

- A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.
- B. The approximate locations of the outlets are indicated on the Drawings. The exact locations shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.
- C. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations.
- D. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.
- E. Outlet boxes shall be firmly anchored in place and shall not depend on the coverplate to hold it secure to the wall.
- F. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 24".

3.04 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.

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- D. Pull boxes shall be installed in accordance with ANSI/TIA-569-D.
- E. Pull boxes shall be grounded in accordance with ANSI-TIA-607-C.

3.05 CABLE TRAY SYSTEM

- A. Install trays in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of the NEC.
- B. All open trays shall be installed a minimum of six (6) inches away from any light fixture.
- C. Provide external grounding strap at expansion joints, sleeves, crossover and other locations where tray continuity is interrupted.
- D. Support all pathways from building construction. Do not support pathways from ductwork, piping or equipment hangers.
- E. Install cable tray level and straight.
- F. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete cable tray system.
- G. Cable trays shall not be used to house both low voltage and power cables unless cables are separated by a grounded physical barrier.
- H. Cable tray system shall be grounded in accordance with ANSI/TIA-607-C.

3.06 CABLE HANGERS

- A. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- B. Install cables using techniques, practices, and methods that are consistent with Category 6 or higher requirements and that supports Category 6 or higher performance of completed and linked signal paths, end to end.
- C. Install cables without damaging conductors, shield, or jacket.
- D. Do not bend cables, in handling or in installing, to smaller radii than minimums

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recommended by manufacturer.

- E. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.
- F. Do not exceed load ratings specified by manufacturer.
- G. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
- H. To avoid electromagnetic interference (EMI), pathways shall provide minimum clearances of four feet from motors or transformers, one foot from conduit and cables used for electrical power distribution, and five inches from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.
- I. Bridle rings shall be installed in ceiling spaces where cables cannot be supported by j-hooks.

3.07 VELCRO STRAPS

- A. Velcro straps shall be installed around cables at intervals of 12" minimum.
- B. Do not over-cinch cables.

3.08 SYSTEM FURNITURE FEEDS

- A. Provide all system furniture feeds in accordance with construction Drawings.
- B. Wall system furniture data/voice feeds
 - 1. Data/voice system furniture feeds shall be installed next to the power feeds where possible, but shall be kept separate in the furniture raceway.
 - 2. The wall feed shall consist of a double gang steel backbox in the wall. Two 1.5" conduits shall be routed from the double gang box inside the wall and stubbed up above the ceiling. The box shall be located at the same height as the power feed box, or centered at 6" A.F.F.
 - 3. The backbox shall have a double-gang stainless steel cover plate with a 2" opening on the center to allow the cabling to exit the wall.

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4. All cabling exiting the cover plate shall be routed inside a plastic or rubber whip, which must be no longer than 4 feet (i.e. the furniture feed must not be located more than 4 feet from the system furniture cable entrance).
5. The whip must be permanently attached to the wall cover plate, and no gap between the cover plate and the whip shall be visible from the outside. Similarly, the whip should go into the system furniture raceway without any visible gaps between the whip and the furniture, and it shall be permanently attached to the raceway.
6. No more than 8 Category 6 cables shall be routed via a system furniture feed. Use additional system furniture feeds for additional cable capacity.
7. If the contractor installing the furniture feed system will not install the data/voice cabling at the same time, pull strings must be provided from the conduit in the ceiling in the backbox, whip, and to the system furniture outlet openings, as to allow easy installation of the cabling by the installers. If the Drawings do not indicate any data/voice outlets to be installed in the furniture, the contractor shall prepare at least two outlets in the furniture for future use (i.e. route the pull-strings, and leave two knockouts in the raceway free for use).
8. Contractor shall ensure that the cabling path from the ceiling to the conduits, backbox, whip, and furniture at all times maintains proper bend radius in accordance with TIA/EIA standards for Category 6 cables.

3.09 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

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SECTION 27-05-43
UNDERGROUND DUCTS & RACEWAYS FOR COMMUNICATIONS
SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Underground Ducts and Raceways for Communications Systems.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of exterior telecommunications pathways 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.

1.02 SUBMITTALS

- A. Provide product data.

1.03 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 complete Conduit System.
 - 2. Furnish and install all Maintenance holes/Handholes.
 - 3. Furnish and install all Conduit Plugs/Caps.

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PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

- A. Rigid/Intermediate Conduit manufacturer(s):
 - 1. Allied
 - 2. Triangle
 - 3. Wheatland
 - 4. Youngstown
- B. PVC/HDPE Conduit manufacturer(s):
 - 1. Carlon
 - 2. Georgia Pipe Company
 - 3. FiberTel
 - 4. Or Approved Equal
- C. Innerduct/Inner-Conduit Channel manufacturer(s):
 - 1. Carlon
 - 2. Endot Industries
 - 3. MaxCell
 - 4. Petroflex
- D. Marker Tape manufacturer(s):
 - 1. William Frick & Associates
 - 2. Or Approved Equal
- E. Approved Maintenance hole/Handhole manufacturer(s):
 - 1. Old Castle
 - 2. Pencil (Handholes Only)
 - 3. Quazite (Handholes Only)
 - 4. Or Approved Equal
- F. Approved Conduit Plug/Cap manufacturer(s):
 - 1. Jack Moon
 - 2. Or Approved Equal

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2.02 CONDUIT SYSTEM

- A. PVC conduit for concrete encasement shall be Type DB, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.
- B. PVC conduit for direct burial shall be Schedule 40, UL Labeled for 90 degrees C cables. Fittings shall be Schedule 40, solvent type, and from the same manufacturer as the conduit.
- C. Concrete shall have a minimum strength of 2,500 psi at 28 days.
- D. Rigid and Intermediate Conduit
 - 1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.
 - 2. Galvanized rigid steel conduit shall be hot dipped galvanized inside and outside, in 10 foot lengths and threaded on both ends. Fittings and bushings shall be threaded, cast or malleable iron, and hot dipped galvanized inside and outside.
- E. Non-Metallic Conduit
 - 1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC / HDPE.
 - 2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.
- F. Conduit Support
 - 1. Conduit straps shall be single-hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.
- G. Innerduct/Inner-Conduit Channel
 - 1. Innerduct shall be non-corrugated PVC equipped with mule tape.
 - 2. Inner-conduit channel shall consist of 3-channels with each channel equipped with mule tape.
- H. Marker Tape

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1. Marker tape shall be detectable, orange for telecommunications, and labeled to indicate the type of circuit buried below.

2.03 MAINTENANCE HOLES/HANDHOLES

A. Maintenance holes

1. Maintenance holes shall be pre-cast or cast in place concrete with a strength of 3,500 psi at 28 days, and steel reinforced.
2. Maintenance holes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.
3. Maintenance holes shall be equipped with grounding busbar.
4. Maintenance holes shall be equipped with racking for cable storage.
5. Ground splices and connections at maintenance holes shall be exothermic welds, copper or bronze compression ground fittings, or bolted compression ring lugs.
6. The cover for maintenance holes shall have the lettering, "COMMUNICATIONS".

B. Handholes

1. Handholes shall be non-conductive and shall not require grounding for safety. Handholes shall be unaffected by freeze/thaw and resistant to sunlight and chemicals. Handholes shall be pre-cast polymer concrete, heavy duty rated and bottomless.
2. Handholes shall be equipped with racking for cable storage.
3. Handholes shall have the word "COMMUNICATIONS" molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
4. Handholes shall be able to withstand 10,000 lbs minimum.

2.04 CONDUIT PLUGS/CAPS

A. Conduit Plugs/Caps

1. Conduit plugs shall provide a watertight seal at expose ends of conduits.
2. Conduit plugs shall be conduit size specific.
3. Triplex and Quadplex duct plugs shall provide a watertight seal between the conduit and innerduct(s).
4. Simplex duct plugs shall provide a watertight seal between the innerduct

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- and the cable that occupies it.
5. Inflatable bladders shall be used to seal conduits equipped with inner-conduit channel (MaxCell).

PART 3 - EXECUTION

3.01 CONDUIT SYSTEM

A. Excavation and Backfill

1. Contractor shall call underground utilities locator company before digging.
2. Barricades shall be provided around open holes and trenches. Temporary bridges shall be provided over trenches cut through major sidewalk routes. Major sidewalk routes shall not be closed to pedestrian traffic.
3. Barriers shall be provided to protect landscaping adjacent to the excavation area.
4. When rocks, concrete or other debris are encountered during excavation, remove completely.
5. Where sidewalk sections must be removed for installation of underground ducts, remove the sidewalk sections completely from joint to joint.
6. Where asphalt must be removed for installation of underground ducts, saw cut the asphalt in two, straight, parallel lines.
7. Backfill excavations in 6 inch layers and mechanically compact to 98 percent compaction.
8. Excavated materials may be used as backfill only if the backfill is sand or clean dirt that is free of rocks and debris over 3/4" in diameter.
9. In landscaped areas, backfill and mechanically compact to a depth of 6 inches below grade.
10. Backfill the last 6 inches with clean topsoil. Reseed lawn areas.
11. Restore concrete sidewalks and asphalt.
12. The contractor shall perform all excavation to install the electrical work herein specified and as indicated on Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut.
13. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, tamped. Remove unstable soil that is not capable of supporting

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equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.

14. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and rammed until the installation has a cover of not less than the adjacent ground but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off

B. Duct Banks

1. Duct banks shall be sloped downward toward maintenance holes and away from buildings a minimum of 6 inches per 100 feet. Duct banks shall not route water from maintenance holes into buildings. Duct banks shall not contain traps between maintenance holes where water may accumulate.
2. Directional changes in duct banks shall be made with 20' minimum radius bends. Duct banks and direct buried ducts shall be supported on undisturbed soil or on piers extending down to undisturbed soil.
3. Where power and telecommunications duct banks run in parallel, they shall be separated by a minimum of 12 inches.
4. Duct banks shall have a minimum of 3 inches of concrete cover on all sides.
5. Prior to concrete encasement, ducts, reinforcing steel and ground wires shall be secured with nonmetallic straps or cable ties to nonmetallic duct spacers at intervals not exceeding 8 feet. Duct spacers shall be sized for the ducts being held, and shall provide the minimum spacing between ducts required for concrete flow and by the NEC. Duct spacers shall be anchored to the ground using nonmetallic bands and stakes.
6. Where duct banks enter maintenance holes or buildings, they shall be constructed as integral to the wall.
7. Duct bank shall extend to the inside surfaces of the walls, and the duct bank reinforcing shall be integrated with the wall reinforcing.
8. Bell ends shall be provided on ducts where the ducts enter maintenance holes or buildings.
9. Direct buried ducts and fittings shall have bend radii greater than the minimum bend radii of the cables enclosed, and shall not be smaller than the radii of standard manufactured elbows.

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10. Direct buried ducts shall be installed parallel to or at right angles to building lines and site features, and as close to curbs and sidewalks as possible to avoid interferences with future landscaping.
11. Where direct buried PVC ducts cannot be buried deep enough to meet the NEC minimum cover requirements, rigid steel conduits shall be installed instead, or a concrete cover shall be poured over the ducts.
12. An orange detectable marker tape (for telecommunications) shall be buried in the backfill approximately 12 inches above duct banks or direct buried cables for the entire length of the duct run.
13. A flexible mandrel and a stiff bristled brush shall be pulled through the ducts to clean them prior to cable pulling.
14. Ducts shall be identified in the maintenance holes and at both ends.

C. Additional OSP Conduit Requirements

1. Leave all empty conduits with a 200-pound test nylon cord pull line.
2. Install a #14 AWG tracer wire in one conduit for the entire length of each duct run.
3. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
4. Install conduit, 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.
5. Where conduits must pass through structural members obtain approval of Architect.
6. 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.
7. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
8. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC/HDPE. 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 NEC. Provide concrete encasement where required or as indicated on Drawings.
9. Seal all conduits entering building to prevent entrance of moisture.

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10. Conduit fittings shall be gland and ring compression type for all conduit exposed to outdoor environments.
11. Below Grade Conduit Installations
 - a. Install top of conduits 24-inches minimum below finished grade or as indicated on Drawings.
 - b. Install top of conduits 6 inches minimum below bottom of building slabs.
 - c. Where transition is made from below grade PVC installation to a metallic conduit system above grade or slab.
12. Telecommunications cables shall not occupy conduits with power cables.
13. All metallic conduits shall be grounded in accordance with ANSI/TIA-607-CMG.
14. For runs that total more than 400 feet in length, insert handholes/maintenance holes so that no segment exceeds the 400 feet limit.
15. Conduit runs shall not have more than two (2) 90-degree bends between pull points.
16. Telecommunication conduit system shall contain no condulets (also known as an LB).

3.02 MAINTENANCE HOLES/HANDHOLES

- A. Handholes shall be installed on a base of pea gravel at least 12 inches deep.
- B. Tops of maintenance holes/handholes shall be level with the existing grade.
- C. Ducts should enter as perpendicular to the wall surface as possible.
- D. Maintenance holes shall be grounded with four 3/4 inch diameter by 8 foot long ground rods, one driven inside of the maintenance hole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the maintenance hole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the maintenance hole.

3.03 CONDUIT PLUGS/CAPS

- A. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until ready for use.
- B. Simplex, triplex or quadplex duct plugs shall be installed in conduits to house and

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seal cables.

- C. Inflatable bladders shall be used to seal conduits equipped with inner-conduit channel (MaxCell).

3.04 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

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IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Identification 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.

1.02 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

1.03 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:

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1. Perform all Labeling.

PART 2 - PRODUCTS

2.01 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

2.02 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.

2.03 SOFTWARE PROGRAM

- A. Software program shall be of the following types or similar:
 1. PANDUIT labeling program
 2. Brady labeling program
 3. Dymo
 4. Excel, customized

2.04 TEMPORARY LABELS

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- A. Vinyl labels, hand written, with permanent marker.

2.05 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.

2.06 AS-BUILT PLAN

- A. Description: At the completion of the project, provide an "as-built" floor plan of each floor to the owner.

PART 3 – EXECUTION

3.01 LABELING REQUIREMENTS

- A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA-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 in-puts shall be turned over to the owner at the end of the project.

3.02 INSTALLATION

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- 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 whenever exposed on minimum 10' intervals
 - 11. Backbone cable at point of termination
 - 12. LAN room and main telecommunications room (MR) punchdown blocks (Voice Outlet and Data Backbone blocks)
 - 13. Ends of any cored cable put in place that is not terminated
 - 14. On front of racks, cabinets frames, active hardware, multiplexers

3.03 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 voice backbone to room 139, 1-25, 26-50, 51-75, etc - 200)

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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. Voice 110 LAN room blocks
8. Data Backbone 110 blocks
9. Ground wires
10. Active hardware and multiplexers (by owner)

3.04 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.

3.05 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.

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3.06 LABELING AND REFERENCE CHARTS

- A. Contractor to provide a labeling reference chart(s) indicating the following:
 - 1. Voice backbone termination of pairs at the local telecommunication room (TR) and main telecommunications room (MR).
 - 2. Voice outlet cable pair termination at the TR.
 - 3. Data patch panel outlet port termination.

3.07 AS-BUILT PLAN & FRAME

- A. Provide and mount frame with "as-built" on TR wall, PBX wall and File Server room wall near the data racks or voice blocks, or as indicated on the plans.

END OF SECTION

SECTION 27-08-00

COMMISSIONING OF COMMUNICATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Commissioning of Communications.
- 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.

1.02 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 Coaxial Cabling Testing.
 - 4. Provide all Documentation, As-Builts, Training and Warranty.

SECTION 27-08-00

PART 2 - TESTING

2.01 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-568-C.2 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 performance. Horizontal balanced twisted pair cabling shall be tested using a level III test unit for category 6 compliance and performance up to 250 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-568-C.2 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.

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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-526-7-A and/or ANSI/TIA-526-14-C 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 multimode optical fiber cable with a power meter / light source. Fiber must be tested at both 850nm and 1300nm. Maximum attenuation dB/Km @ 850nm/1300nm shall be 3.0/1.5. Maximum attenuation per connector pair shall be .75 dB.
5. Singlemode
 - a. Test the singlemode optical fiber cable bi-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. Coaxial Testing

1. Sweep testing of each reel of coaxial cable shall be performed over the 5 MHz through 1 GHz range by the cable manufacturer for transmission and structural return loss and be so certified in writing by the cable manufacturer.
2. Signal level at each outlet shall be +5 dBmv, + 3 dB; applies only if contractor's scope of work includes implementing video distribution system.
3. Standard for signal strength measurement shall be a calibrated field strength meter; applies only if contractor's scope of work includes implementing video distribution system.

E. Test Results

1. Test documentation shall be provided on a CD or Thumb Drive 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

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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-568-C.2.
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 (CD). These 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

3.01 DOCUMENTATION & AS-BUILTS

- A. As-Built record documentation for telecommunications work shall include:
 - Cable routing and identification
 - System function diagrams
 - Manufacturers' description literature for equipment
 - Connection and programming schedules as appropriate
 - Equipment material list including quantities
 - Spare parts list with quantities
 - Details not on original Contract
 - Documents Test Results
 - Warranties
 - Release of Liens

SECTION 27-08-00

- 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. As-built drawings shall be generated in AutoCad 2002 or later. Submit as-built drawings electronically on C.D. and hard copy.

3.02 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,

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- 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.

3.03 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.

3.04 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. Voice & Data Structured Cabling
 - 1. Manufacturer(s) shall provide a Limited Lifetime
 - 2. Warranty for components used in the installed Voice & Data Structured Cabling System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.
- C. CATV Infrastructure
 - 1. Manufacturer(s) shall provide a 1-year warranty for components used in the installed CATV Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

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D. 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

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SECTION 27-10-00 STRUCTURED CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Transmission performance of structured cabling varies with length, connecting hardware, cords and total number of connections. The installer must take care to properly install the cabling components. To ensure that the installed structured cabling solution meets or exceeds the required performance it must be 'tested' or 'certified'.
- B. The requirements for each category of cabling (Cat5e, Cat6, or Cat6A) and optical fiber optics links are located in the ANSI/TIA-568 series standards.
- C. Test equipment must meet the requirements set forth in the ANSI/TIA-568 series Standard for Field Test Equipment. All Copper testers shall be Level III. All fiber testers shall meet the requirements in ANSI/TIA-568.
- D. Field Power Meters shall meet the following:
 - Accuracy ± 0.2 dB
 - Resolution 0.01 dB
 - Precision ± 0.15 dB
- E. The Field light source shall meet the following:
 - Accuracy ± 0.01 dB
 - Wavelength 850 ± 30 nm, 1300 ± 50 nm, 1310 ± 30 nm, 1550 ± 30 nm
- F. The calibration on all test equipment shall be current.
- G. The software in all test equipment shall be current.

1.02 MANUFACTURERS

- A. FLUKE
 - OptiFiber OTDR
 - DTX-CLT CertiFiber Optical Loss Test Set
- B. Ideal
 - LANTEK II
 - LANTEK 6/6A/7G
 - FIBERTEK
- C. Or other test equipment approved by the Owner.

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PART 2 – SYSTEMS TESTING AND DOCUMENTATION

1.01 GENERAL REQUIREMENTS

- A. Provide installation testing of equipment where required by manufacturer's installation instructions.
- B. Provide complete end to end testing for all copper and fiber optic systems/channels based on latest applicable standards. Document all testing and submit with final as-built submittal package.
- C. For all controls and operating equipment, submit equipment/systems to at least three complete operational sequences, in which all equipment operations are tested, observed, and verified.
- D. Prior to substantial completion and project acceptance inspection, submit test reports to indicated scope of startup and operational tests, with results of testing for each specified operation.

1.02 COPPER CABLING SYSTEM TESTING

- A. General: Copper cabling shall be tested and certified after installation as follows and as required for cable manufacturer's warranty. Twisted-pair copper cable channels shall be tested for continuity as specified below, presence of ac/dc voltage, and performance. All cabling shall be tested for conformance to horizontal cable specifications as outlined herein, and shall be tested per test set manufacturer's instructions utilizing latest firmware and software. Testing shall include all electrical parameters as specified under Product. All cables and termination hardware shall be 100 percent tested by installation contractor for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by Contractor prior to system acceptance. All cables shall be tested per contract documents, manufacturer's warranty provisions, and best industry practices. If any of these are in conflict, Contractor shall comply with most stringent requirements. All defects in cabling system installation shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed, at no additional cost to Owner.
- B. 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 test unit per manufacturers recommended procedures, and referenced to appropriate cable identification number and circuit or pair number. Any faults in wiring shall be corrected and cable re-tested prior to final acceptance.
- C. 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

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panel to outlet or block to outlet as appropriate. The cable length shall conform to maximum distances set forth in ANSI/TIA-568-C standards and all other applicable standards specified in Telecommunications Industries Association (TIA) document. Cable lengths shall be recorded, referencing cable identification number and circuit or pair number. For multi-pair cables, shortest pair length shall be recorded as length for cable.

- D. Factory testing: Every reel of cable shall be tested by cable manufacturer for all characteristics specified for cable type in this section. This testing shall be performed using a sweep test method and include frequencies specified for cable. A test report shall be available electronically, at no additional cost, for a minimum of five (5) years from the date of manufacture. The test report shall include the reel number, the date of the test, the Lot number, and test results for Return Loss (RL), Insertion Loss (Attenuation), Pair-to-Pair NEXT, and Power Sum NEXT Pair-to-Pair ELFEXT and Power Sum ELFEXT. The test report shall show the "Worst Case Margin" for the listed transmission characteristics.
- E. Test results: Test results shall be automatically evaluated by equipment, using most up-to-date criteria from TIA-568-C standards and all other applicable standards specified in Telecommunications Industries Association (TIA) document and result shown as pass/fail. Test results shall be printed directly from test unit or from a download file using an application from test equipment manufacturer. The printed test results shall include all tests performed, expected test result and actual test result achieved.
- F. Test reports: Test reports for all factory testing and field test reports for copper cabling installation shall be submitted to the Owner's Representative and manufacturer prior to commissioning voice and data system and final contract payment. Refer to Submittals in this Section.

1.02 COPPER CABLING SYSTEM TESTING

- A. General: Optical fiber cabling shall be tested and certified after installation as described below and as required for cable manufacturer's warranty. Fiber testing shall be performed on all fibers in completed end to end system. Testing shall consist of a bi-directional end to end test in accordance with applicable standards in 27 02 20.20, or a bi-directional end to end test performed by TIA-455-53A and all other applicable standards in 27 02 20.20. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode type glass and 1310 and 1550 nanometers for single-mode type glass. These tests shall also include continuity checking of each fiber. For spans greater than 90 meters, each tested span must test to a value less than or equal to value determined by calculating a link loss budget. For horizontal spans less than or equal to 90 meters, each tested span must be less than or equal to 2.0 decibels. The insertion loss for each mated optical fiber connector pair shall not exceed 0.40 decibels.
- B. Pre-installation testing: Test all optical fiber cable for all fibers prior to installation of

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- cable.
- C. Performance testing: Where links are combined to complete a circuit between devices, Contractor shall test each link from end to end to ensure performance of system. Only a basic link test is required. Contractor can optionally install patch cords to complete circuit and then test entire channel. The test method shall be same used for test described above. The values for calculating loss shall be those defined in applicable TIA standards in Telecommunications Industries Association (TIA) document.
 - D. Attenuation testing: Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach test equipment to cable plant. The light source shall be left in place after calibration and power meter moved to far end to take measurements.
 - E. Loss budget: All fiber cabling shall be tested at both wavelengths 850 nm and 1310 nm for multimode and 1300 nm and 1550 nm for single mode.
 - The link attenuation shall be calculated using:
 - The Corning link loss Fiber Performance Calculator for installations
 - The following calculation for other installations:
 - $\text{Link Attenuation Allowance (dB)} = \text{Cable Attenuation (dB)} + \text{Connector loss (dB)} + \text{Splice Insertion Loss (dB)}$ Where: $\text{Cable attenuation (dB)} = \text{Cable attenuation (dB/km)} \times \text{Length (km)}$ $\text{Connector loss (dB)} = \text{Number of Connector pairs} \times \text{Allowable connector loss (dB)}$ $\text{Splice Insertion Loss (dB)} = \text{Number of Splices} \times \text{Allowable Splice loss (dB)}$
 - F. Link loss: A mated connector to connector interface shall be considered a single connector. Loss numbers for installed link shall be calculated by taking sum of bi-directional measurements and dividing that sum by two. All links not meeting requirements of standard shall be brought into compliance by Contractor, at no additional cost to Owner.
 - G. Documentation: Following final documentation shall be submitted to the owner's representative prior to commissioning data system and final contract payment according to Submittals in this section.
 - H. Test results: Test results shall be automatically evaluated by equipment, using most up-to-date criteria from all applicable standards specified in 27 02 20.20 and result shown as pass/fail. Test results shall be printed directly from test unit or from a download file using an application from test equipment manufacturer. The printed test results shall include all tests performed, expected test result and actual test result achieved.
 - I. End to End Loss Data: final documentation shall be submitted to the owner's representative.
 - J. As Installed/ As Built Diagrams: Final documentation shall be submitted to the owner's representative.

1.03 TEST DOCUMENTATION

- A. Electronic Format – if required
 - 1. Certification Test Reports shall be submitted in electronic format using the appropriate software supplied by the test equipment manufacturer. The data

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format should be that of the test report software (i.e. *.flw files for Fluke). The contractor shall provide any necessary software to view and evaluate the test data.

2. The following list is provided as a reference:

Tester	Test Report Software
Fluke	LinkWare
Ideal	LanTek Reporter

3. One electronic copy of the Test Reports shall be provided.

B. Paper Format – if required

1. Provide test documentation in 3-ring binders within 2 weeks after completion of project testing. Binders shall be clearly marked on outside front cover and spine with words Test Results, project name, and date of completion (month and year). Major heading tabs, Horizontal and Backbone, shall divide binder. Each major heading shall be further sectioned by test type. Within horizontal and backbone sections, divide by tabs scanner test results by category, optical fiber attenuation test results, and continuity test results. Present test data within each section in sequence listed in administration records. Test Reports shall be submitted in electronic format using the appropriate software supplied by the test equipment manufacturer. The data format should be that of the test report software (i.e. *.flw files for Fluke). The contractor shall provide any necessary software to view and evaluate the test data.
2. Provide test equipment by name, manufacturer, model number and last calibration date at the end of document. Unless manufacturer specifies more frequent calibration cycle, annual calibration cycle shall be required on all test equipment used for this installation.
3. Test document shall detail test method used and specific settings of equipment during test. Scanner tests shall be printed on 8 1/2 by 11 inches. Hand written test results (attenuation results and continuity results) shall be documented on a suitable test form.
4. When repairs and re-tests are performed, note problem found and corrective action taken, and collocate in binder both failed and passed test data.

END OF SECTION

SECTION 27-11-13

SECTION 27-11-13

COMMUNICATIONS ENTRANCE PROTECTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Entrance Protection.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of backbone 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.

1.02 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 Building Entrance Protector Terminals.
 - 2. Furnish and install all Bonding Shield Connectors.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

- A. Approved Building Entrance Protector Terminal manufacturers:
 - 1. Circa
 - 2. Marconi
 - 3. Porta Systems

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4. Tii Technologies

B. Approved Bonding Shield Connector manufacturers:

1. 3M
2. Or Approved Equal

2.02 BUILDING ENTRANCE PROTECTOR TERMINALS

A. Indoor Building Entrance Protector Terminal

1. The indoor building entrance protector terminal shall be equipped with 110-connector inputs and outputs and shall accommodate industry standard 5-pin protection modules.
2. The indoor building entrance protector terminal shall protect up to 100-pairs and shall be equipped with an internal fuse link.
3. The indoor building entrance protector terminal shall be wall or frame mountable, and able to be stacked for future expansion.
4. The indoor building entrance protector terminal shall be equipped with external ground connectors that accept 6-14 AWG ground wire.

B. Solid State Surge Protection Modules

1. The solid-state surge protector module shall be 5-pin and shall provide transient and power fault protection for standard telephone line applications.
2. The solid-state surge protector module shall be designed to provide a balanced configuration to protect against line-to-line metallic surges.
3. The solid-state surge protector module shall feature an external failsafe mechanism, which permanently grounds module under sustained high current conditions.
4. The solid-state surge protector module shall feature nanosecond response time and safe mode operation in adverse situations.
5. The solid-state surge protector module shall be UL & cUL Listed.

2.03 BONDING SHIELD CONNECTOR

A. Shield Connector

1. The purpose of the bonding shield connector is to make a stable, low resistant electrical connection between the shield of a communications cable and a ground conductor.
2. The bonding shield connector shall be tin-plated tempered brass

SECTION 27-11-13

PART 3 - EXECUTION

3.01 BUILDING ENTRANCE PROTECTOR TERMINALS

- A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the telecommunications equipment closet busbar.
- B. Building entrance protector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-C Telecommunications Bonding and Ground Standard.
- C. Building entrance protector panels shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.02 BONDING SHIELD CONNECTOR

- A. Bonding shield connector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-C Standard.
- B. Bonding shield connector shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.03 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling detail

END OF SECTION

SECTION 27-11-16

SECTION 27-11-16 CABINETS, RACKS & ENCLOSURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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.

1.02 RELATED DOCUMENTS

This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment:

- A. Section 27-00-00 - Structured Cabling General Requirements
- B. Section 27-05-10 - Fire stopping
- C. Section 27-05-26 – Grounding and Bonding for Communications Systems
- D. Section 27-05-28 – Pathways for Communications Systems
- E. Section 27-05-43 - Underground Ducts and Raceways
- F. Section 27-05-53 - Identification
- G. Section 27-08-00 - Commissioning
- H. Section 27-11-13 – Entrance Protection
- I. Section 27-11-19 – Communications Terminations, Blocks, and Patch Panels
- J. Section 27-11-23 – Cable Management and Ladder Racking
- K. Section 27-11-26 – Rack Mounted Power Strips
- L. Section 27-13-13 – Copper Backbone Cabling
- M. Section 27-13-23 – Optical Fiber Backbone Cabling
- N. Section 27-13-33 – Coaxial Backbone Cabling
- O. Section 27-15-00 - Copper Horizontal Cabling
- P. Section 27-15-43 – Faceplates and Connectors
- Q. Section 27-60-60 – CATV Distribution Equipment

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1.03 SUBMITTALS

- A. Provide product data.

1.03 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

2.01 APPROVED PRODUCTS (see attachment "Appendix B" for approved product material list)

- A. Equipment Racks
- B. Equipment Cabinets

2.02 TELCO EQUIPMENT RACKS

- 1. Telco Equipment Racks shall be constructed of high strength, lightweight bolted aluminum.
- 2. Unless otherwise specified in the drawings, all Telco Equipment Racks shall be two rail systems.
- 3. Telco Equipment rack shall have a minimum weight bearing capacity of 1,500 lbs.
- 4. The vertical rails of the equipment rack shall be equipped with the threaded EIA hole pattern, both front and rear.
 - a. Rack shall be: 7' in Height
 - b. Rack shall be no wider than 21"
 - c. Rack shall have EIA 19"W threaded mounting holes
 - c. Rack color shall be clear.

2.03 HIGH DENSITY FIBER DISTRIBUTION FRAME

- A. High Density Fiber Distribution Frame

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1. The Fiber Distribution Frame shall be made of high strength metal.
2. The Fiber Distribution Frame shall provide space for the termination of up to 1728 fiber strands.
3. The Fiber Distribution Frame shall provide clear cable paths and patch cable slack management for intermodal patching of all 1728 terminations in the same frame.
4. Approved Vendor
 - a. ADC/TYCO Electronics
 - i. Frame Part Number: NGF-MDF7A100-300
 - ii. End Guard Part Number: NGF-ACCEED007

2.04 EQUIPMENT CABINETS

A. Equipment Cabinets

1. The frame of the equipment cabinet shall be constructed of high strength, lightweight aluminum or high strength steel.
2. Front and rear doors of the equipment cabinet shall be lockable.
3. The vertical rails of the equipment cabinet shall be equipped with the EIA hole pattern.
4. The equipment cabinet shall be equipped with a fan unit.
 - a. Cabinet shall be: 7'H x 19"W x 30"D floor mounted.
 - c. Cabinet color shall be gray.

2.05 EQUIPMENT SHELVES

A. Center Mount Equipment Shelves

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1. The center mount equipment shelf shall be constructed of high strength, lightweight aluminum.
2. The center mount equipment shelf shall be a minimum depth of 19".
3. The center mount equipment shelf shall support a minimum of 100lbs.
 - a. Center mount equipment shelf color shall be gray.

PART 3 - EXECUTION

3.01 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 36 inches in the front and 66 inches in the rear.
- 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.

3.02 BACKBOARDS

- A. Backboards shall be 3/4" void free plywood. Size of backboard shall be 4' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint.

3.03 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-11-19

SECTION 27-11-19

COMMUNICATIONS TERMINATIONS, BLOCKS, AND PATCH PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes the products and specification requirements for Telecommunications Rooms (TR) Blocks and Patch Panels
- B. 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 RELATED DOCUMENTS

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment:
 - A. Section 27-00-00 - Structured Cabling General Requirements
 - B. Section 27-05-10 - Fire stopping
 - C. Section 27-05-26 – Grounding and Bonding for Communications Systems
 - D. Section 27-05-28 – Pathways for Communications Systems
 - E. Section 27-05-43 - Underground Ducts and Raceways
 - F. Section 27-05-53 - Identification
 - G. Section 27-08-00 - Commissioning
 - H. Section 27-11-13 – Entrance Protection
 - I. Section 27-11-16 – Cabinets Racks and Enclosures
 - J. Section 27-11-23 – Cable Management and Ladder Racking
 - K. Section 27-11-26 – Rack Mounted Power Strips
 - L. Section 27-13-13 – Copper Backbone Cabling
 - M. Section 27-13-23 – Optical Fiber Backbone Cabling
 - N. Section 27-13-33 – Coaxial Backbone Cabling
 - O. Section 27-15-00 - Copper Horizontal Cabling
 - P. Section 27-15-43 – Faceplates and Connectors
 - Q. Section 27-60-60 – CATV Distribution Equipment

1.3 REFERENCES

- A. All work shall be performed in accordance with the following codes and industry standards, unless noted otherwise:

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- A. NFPA 70 – National Electrical Code, current version adopted by local or State AHJ.
- B. TIA-568-C.2 – Commercial Building Telecommunications Cabling Standard, current version.
- C. TIA/EIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces, current version.
- D. TIA/EIA-606-B – Administration Standard for Commercial Telecommunications Infrastructure, current version.
- E. ANSI/TIA-607-C –Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, current version.
- F. IEEE 241 - IEEE Recommended Practice for Electric Power Systems in Commercial Buildings” pertaining to communication systems.

1.4 SYSTEM DESCRIPTION

- A. This section describes the acceptable products, procedures and best practices for the installation of Communications blocks and Patch Panels.
- B. Telecommunications contractor shall furnish and install all materials necessary for a complete and working system.

1.5 WARRANTY

- A. The Telecommunications / Networking contractor must be an approved Ortronics (Legrand) Certified Contractor at a Plus tier (CIP, or CIP-ESP) and able to provide nCompass warranty. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with all manufacturer guidelines. Ortronics / Superior Essex (nCompass) will extend a Limited Lifetime or 25 year warranty to the End User for projects completed upon receipt of test results.
- B. All necessary documentation for warranty registration must be provided to Legrand and Georgia State University Information Systems and Technology Group and will be furnished by the Telecommunications Contractor immediately following 100% testing of all cables. All test results shall be submitted in the certification tester’s original software on CD.
- C. Telecommunications Contractor shall administer the warranty process with the responsible manufacturer’s representative. The warranty shall be provided directly to the owner from the manufacturer. Telecommunications contractor shall insure that the manufacturer provides the Owner (Georgia State University Information Systems and

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Technology Group), with the appropriate warranty certification within 30 calendar days of the final project completion.

PART 2 - PRODUCTS

2.1 APPROVALS AND SUBSTITUTIONS

- A. All products shall be provided as specified, without exception, unless approved in writing by Georgia State University Information Systems and Technology Group prior to the bid.
- B. Non-compliant products installed as a part of this Contract shall be removed and replaced and all costs for removal and replacement shall be borne solely by the Contractor(s).
- C. All products shall be “NEW”.

2.2 APPROVED PRODUCTS (see attachment “Appendix B” for approved product material list)

- A. Fiber Enclosures
- B. S110 Block

3.1 EXECUTION

- 1. Category 6 patch panel terminations shall be compliant with ANSI/TIA 568-C.2 standards, and manufacturer recommendations.
- 2. Fiber optic patch panel terminations shall be compliant with ANSI/TIA 568-3.D standards, and manufacturer recommendations.
- 3. Unless exact location is specified in the drawing set, Contractor shall coordinate the placement of all patch panels with the owner. Georgia State University Information Systems and Technologies.
- 4. Unless exact location is specified in the drawing set, the contractor shall coordinate the placement of all Category 6 patch panels with the owner. Georgia State University Information Systems and Technologies.

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3.2 Category 6 Patch Panels

A. General

1. Category 6 Patch Panes shall be compliant with ANSI/TIA 568-C.2.0 standards and manufacturers recommendations.
2. Category 6 Patch Panels Shall be compatible with 19" Telco racks, 19" ISO equipment cabinets, or wall mount brackets.
3. The Category 6 patch panel shall be equipped with 8-position modular ports and shall be terminated using a T568B wiring scheme.
4. Unless exact placement of the Category 6 Patch Panel is specified in the drawing sets, the contractor shall coordinate the placement of the Patch Panels with the owner, Georgia State University Information Systems and Technologies.

B. 48-Port, Category 6 Unshielded Twisted Pair Patch Panels

1. Category 6 unshielded twisted pair patch panel shall be compliant with ANSI/TIA 568-C.2.0 standards.
2. Category 6 unshielded patch panels shall only be used to terminate Category 6 unshielded cables.

C. 48-Port Category 6 Shielded Twisted Pair Patch Panels

1. The Category 6 Shielded twisted pair patch panel shall be compliant with ANSI/TIA 568-C.2.0 standards.
2. Category 6 Shielded twisted pair patch panels shall only be used to terminate Category 6 SFTP cables.

3.3 Fiber Optic Patch Panels

A. General

1. Fiber optic patch panel terminations shall be compliant with ANSI/TIA 568.3 standards, and manufacturer recommendations.
2. Unless exact placement of Fiber Optic Patch Panels is specified in the drawing sets, the contractor shall coordinate the placement of the patch panel with the owner, Georgia State University Information Systems and Technologies.

B. Low Density 2 Slot Optical Fiber Termination Panel

- a. The 2 Slot Optical Fiber Termination Panel shall be compatible with 19" Telco equipment Racks, 19" Equipment Cabinets and wall mount brackets.
- b. The 2 Slot Optical Fiber Patch Panels shall be used in all communications closets that have more than 12 or less fiber terminations.
- c. The 2 Slot Optical Fiber Termination Panels shall use SC terminations for multi-mode.
- d. The 2 Slot Optical Fiber Termination Panels shall use SC Ultra Polished terminations for Single-mode terminations.

C. Medium Density 12 Slot Optical Fiber Termination Panel

- a. The 12 Slot Optical Fiber Termination Panel shall be compatible with 19" Telco equipment Racks, 19" Equipment Cabinets and wall mount brackets.
- b. The 12 Slot Optical Fiber Patch Panels shall be used in all communications closets that have more than 12 and less than 432 fiber terminations.

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- c. The 12 Slot Optical Fiber Termination Panels shall use SC terminations for multi-mode applications.
- d. The 12 Slot Optical Fiber Termination Panels shall use SC Ultra Polished terminations for Single-mode fiber installations.
- D. High Density 144-Port Optical Fiber Termination Panel
 - a. The 144 Port Optical Fiber Termination Panel shall be compatible with ADC NGF-MDF7A100-30 Fiber Distribution Frame.
 - b. The 144 Port Optical Fiber Termination Panels shall be used in all communications closets that have more than 432 fiber terminations in a specific location.
 - c. The 144 Port Optical Fiber Termination Panel shall use LC Ultra polished connectors for Single-Mode fiber terminations.

3.4 S110 Wall Mount Field Termination Units

- A. Wall Mount Field Termination Units shall be mounted in a level horizontal position.
- B. Wall Mount Field Termination Units shall have approved horizontal cable managers installed on top and bottom of all units.
- D. Wall Mount Field Termination Units shall have approved Vertical Cable Managers installed in all applicable positions.
- E. Wall Mount Field Termination Units shall have cable labeling strips installed on all units.
- F. Wall Mount Field Termination Units shall be mounted no lower than 2' from the ground.
- G. Unless specified on the drawings, the location for mounting of Wall Mount S110 Field Termination Units shall be coordinated with the owner, Information Systems and Technology.

END OF SECTION

SECTION 27-11-23

SECTION 27-11-23
COMMUNICATIONS CABLE MANAGEMENT & LADDER RACKS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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.

1.02 SUBMITTALS

- A. Product data.

1.03 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 Cable Management.
 - 2. Furnish and install all Vertical Cable Management.
 - 3. Furnish and install Ladder Rack System.
 - 4. Furnish and install all Velcro Straps.

SECTION 27-11-23

5. Furnish and install all C-Rings/D-rings.

PART 2 – PRODUCTS

2.01 APPROVED PRODUCTS (see attachment “Appendix B” for approved product material list)

- A. Horizontal Cable Management manufacturer(s)
- B. Approved Vertical Cable Management manufacturer(s)
- C. Approved Ladder Rack System manufacturer(s):
- D. Approved Velcro Strap manufacturer(s):
- E. Approved C-Ring/D-ring manufacturer(s):

2.02 CABLE MANAGEMENT - HORIZONTAL

- A. Horizontal Cable Management
 - 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.

2.03 CABLE MANAGEMENT - VERTICAL

- A. Vertical Cable Management

SECTION 27-11-23

1. The vertical cable manger 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".
 - a. Vertical Cable Manager color shall be gray.

2.04 LADDER RACKS

- A. Ladder Rack System
 1. The ladder rack system shall be securely mounted with hardware designed for use in ladder rack systems.
 2. 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.
 - a. Ladder Rack System color shall be gray.

2.05 VELCRO STRAPS

- A. Velcro Straps
 1. All cables shall be fastened to support structures with Velcro straps.
 - a. Velcro Strap color shall be black.

2.06 C-RINGS/D-RINGS

- A. C-Rings/D-rings
 1. C-rings/D-rings shall be used on backboards to support cables, patch cords and cross-connect wire.
 2. C-rings/D-rings shall be made of high-strength, fire-retardant material with rounded edges to prevent damage to cable and wire insulation.

2.07 LADDER RACK DROP-OUT SHIELD

- A. Ladder Rack Drop-Out Shield

PART 3 - EXECUTION

SECTION 27-11-23

3.01 CABLE MANAGEMENT - HORIZONTAL

- A. Horizontal cable managers shall be installed below patch panels in a 1:1 ratio (one horizontal cable manager per patch panel) or as indicated on Drawings.

3.02 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.

3.03 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.

3.04 VELCRO STRAPS

- A. Velcro straps shall be installed around cables at intervals of 12" minimum.
- B. Do not over-cinch cables.

3.05 C-RINGS/D-RINGS

- A. C-ring/D-rings shall be installed on 3/4" backboard, straight and level.

3.06 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.

3.07 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-11-26

COMMUNICATIONS RACK MOUNTED POWER STRIPS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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.

1.02 SUBMITTALS

- A. Provide product data

1.03 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

SECTION 27-11-26

2.08 APPROVED PRODUCTS (see attachment “Appendix B” for approved product material list)

- A. Approved Power Strip manufacturer(s):

2.02 POWER STRIPS

- A. Power Strip

1. The power strip shall be equipped with a minimum of six (6) 3-prong, 120 VAC outlets, 12' cord and an on/off switch.
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

3.01 POWER STRIPS

- A. Power strips shall be installed as per the requirements specified by the manufacturer's installation guidelines.
- B. Appendix A for installation location on rack(s)/cabinet(s).

3.02 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-13-13

SECTION 27-13-13
COMMUNICATIONS COPPER BACKBONE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Copper Backbone.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of backbone 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.

1.02 SUBMITTALS

- A. Provide product data

1.03 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 Backbone Cable (Inside Plant).
 - 2. Furnish and install all Copper Backbone Cable (Outside Plant).

PART 2 - PRODUCTS

SECTION 27-13-13

2.01 APPROVED PRODUCTS (see attachment “Appendix B” for approved product material list)

- A. Approved Copper Backbone Cable (Inside Plant) manufacturer(s):
 - 1. Superior Essex
- B. Approved Copper Backbone Cable (Outside Plant) manufacturer(s):
 - 1. Superior Essex

2.02 COPPER BACKBONE CABLE (INSIDE PLANT)

- A. 100-Ohm, Balanced Twisted Pair Building Backbone Cables (Inside Plant)
 - 1. Generic Characteristics:
 - a. The inside plant building backbone cable shall meet 100-Ohm, balanced twisted pair backbone cable requirements per the latest issue of ANSI/TIA/EIA-568-C.2.
 - b. The inside plant 100-Ohm, balanced twisted pair cable shall be CMP rated.
 - c. The inside plant building backbone cable core shall consist of 25-pair sub-units.

2.03 COPPER BACKBONE CABLE (OUTSIDE PLANT)

- A. 100-Ohm PE-89 Backbone Cables (Outside Plant)
 - 1. Generic Characteristics:
 - a. The outside plant backbone cable shall be assigned the RUS designation of PE-89.
 - b. The outside plant backbone cable core shall consist of 25-pair sub-units.
 - c. The outside plant backbone cable shall contain water-blocking technology and have a jacket made of polyethylene.

PART 3 - EXECUTION

3.01 BACKBONE CABLES (INSIDE PLANT)

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-C.2 document, manufacturer's recommendations and

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best industry practices.

- B. Backbone cables shall be installed separately from horizontal distribution cables
- C. 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.
- D. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
- E. Exposed cables must be CMP rated.
- F. Where backbone cables and horizontal cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- G. Leave 10' of slack on each end of copper backbone cable.
- H. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- I. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- J. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.
- K. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.
- L. Copper cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- M. Each copper cable shall be clearly labeled on the cable jacket behind the patch panel 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.

3.02 BACKBONE CABLES (OUTSIDE PLANT)

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- A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the wall in the proximity of the termination field.
- B. All cables shall be tagged and identified within the handhole/maintenance hole.
- C. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.
- D. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.
- E. Ventilate maintenance where gas has been detected before entering the maintenance hole.
- F. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.
- G. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.
- H. Copper backbone cables shall be bonded and grounded in accordance with the recommendations made in the J-STD-607-A standard, manufacturer's recommendations and best industry practice.

3.03 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-13-23

SECTION 27-13-23

COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Optical Fiber Backbone Cabling.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of backbone 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.

1.02 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

1.03 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:

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1. Furnish and install all Optical Fiber Backbone Cable (Inside Plant).
2. Furnish and install Optical Fiber Backbone Cable (Outside Plant).
3. Furnish and install all Optical Fiber Connectors.
4. Perform all Optical Fiber Splices.
5. Furnish and install all Splice Cases.

PART 2 – PRODUCTS

2.01 APPROVED PRODUCTS (see attachment “Appendix B” for approved product material list)

- A. Approved Optical Fiber Backbone Cable (Inside Plant) manufacturer(s):
- B. Approved Optical Fiber Backbone Cable (Outside Plant) manufacturer(s):
- C. Approved Optical Fiber Connectivity manufacturer(s):
- D. Approved Splice Case manufacturer(s):

2.02 OPTICAL FIBER BACKBONE CABLE (INSIDE PLANT)

- A. Plenum - Indoor Distribution 50/125 OM-3 Multimode Optical Fiber Non-Conductive (OFNP) Tight Buffered Cable
 1. Generic Characteristics:
 - a. The indoor optical fiber cable shall be available with up to twelve 900-micron tight-buffered 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.
 - b. The indoor optical fiber cable shall have sequential length marking printed on the cable jacket.
 - c. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.5
 - d. Bandwidth 500 MHz-km @ 850 nm.
 - e. Bandwidth 500 MHz-km @ 1300 nm.
- B. Plenum - Indoor Distribution 8.3/125-micron Singlemode Optical Fiber Non-Conductive (OFNP) Tight Buffered Cable
 1. Generic Characteristics:
 - a. The indoor optical fiber cable shall be available with up to twelve 900-micron tight-buffered, 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.
 - b. The indoor optical fiber cable shall have sequential length markings printed on the cable jacket.

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- c. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure or wall-mounted enclosure.
- d. The loss of fiber shall not exceed 1.0 dB per kilometer @ 1550 nm and 1.0 dB per kilometer @ 1310 nm.

2.03 OPTICAL FIBER BACKBONE CABLE (OUTSIDE PLANT)

A. Indoor/outdoor 50/125 Multimode Optical Fiber Non Conductive (OFNR) Loose Tube cable

1. Generic Characteristics:

- a. The indoor/outdoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle with moisture-blocking technology.
- b. The indoor/outdoor optical fiber cable shall have sequential length markings printed on the cable jacket.
- c. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.5
- d. Bandwidth 500 MHz-km @ 850 nm.
- e. Bandwidth 500 MHz-km @ 1300 nm.

B. Indoor/outdoor 8.3/125-micron, Singlemode Optical Fiber Non Conductive (OFNR) Loose Tube cable.

1. Generic Characteristics:

- a. The indoor/outdoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle with moisture-blocking technology.

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- b. The indoor/outdoor optical fiber cable shall have sequential length markings printed on the cable jacket.
- c. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure or wall-mounted enclosure.
- d. The loss of fiber shall not exceed 0.50 dB per kilometer @ 1550 nm and 0.50 dB per kilometer @ 1310 nm.

2.04 OPTICAL FIBER CONNECTORS

A. Multimode Fiber Connectivity:

- 1. The optical fiber field-installable connector shall be SC format, for installation onto either multimode 50/125-micron fiber.
- 2. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers or 250-micron loose-tube fibers.
- 3. The optical fiber field-installable connector shall have a maximum Loss of .5 dB.
- 4. The optical fiber field-installable connector shall have a typical Reflectance of -30 dB.

B. Singlemode Fiber Connectivity:

- 1. The optical fiber field-installable connector shall be SC format, for installation onto singlemode 8.3/125-micron fiber.
- 2. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers or 250-micron loose-tube fibers.
- 3. The preferred method of terminating loose-tube singlemode fiber is pigtail splicing into a rack mounted optical fiber panel or wall-mounted enclosure. Pigtails shall be factory terminated and 3 meters in length. A fiber enclosure with slack storage trays must be used when pigtail-splicing method is used.
- 4. The splice loss through each connector pair shall not exceed 0.50 dB.
- 5. All singlemode connectors (pigtails and field terminated) shall be SC.

2.05 SPLICE CASES

A. Canister Splice Case

- 1. Splice cases shall be water tight and designed for outside plant applications.
- 2. All splice trays, seals and hardware shall be from the same manufacturer as the splice case.
- 3. Splice trays shall utilize heat-shrink seals.

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PART 3 - EXECUTION

3.01 GENERAL GUIDELINES

- A. Provide optical fiber cable from each telecommunications room (TR) to the main telecommunications room (MR). Refer to building backbone cabling drawings for exact counts. Optical fiber cable shall be installed inside buildings using the same methods as twisted pair; however, the manufacturers' guidelines regarding the following should be observed:
 - 1. Do not exceed the manufactures maximum pulling tension.
 - 2. Do not exceed minimum installed and long term bend radius.
 - 3. Avoid sharp bends and corners.
 - 4. Provide additional crush/mechanical protection in high-risk environments.
 - 5. Do not exceed maximum vertical rise specification unless intermediate tension relief is used.
 - 6. Observe all governing building and fire codes (either by using a properly listed cable or suitable raceway).
 - 7. Secure the optical fiber cable to existing supports or large cables wherever possible.
 - 8. Do not deform the cable jacket, specifically when using Velcro straps.

3.02 OPTICAL FIBER INSTALLED IN CABLE TRAYS / LADDER RACKS

- A. Install optical fiber cable so as to minimize potential damage when additional cables are installed or retrieved. (install fiber to one side of the cable tray or cable rack, limiting contact with other cables)
- B. Maintain minimum bend radius around corners through the use of a fiber guide.
- C. All optical fiber cabling shall be routed in innerduct or conduit
- D. Secure cable to tray every 12" to 24."

3.03 OPTICAL FIBER INSTALLED IN VERTICAL RUNS

- A. Work from the top down, when possible.

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- B. Secure the cable in innerduct every 24 to 36 inches to cable rack tray.
- C. Install intermediate split wire mesh grip(s) wherever the maximum vertical rise is exceeded.
- D. Secure the cable in the backbone cabling in telecommunications rooms (TR) with Velcro straps as needed to prevent accidental damage to cable.

3.04 UNDERGROUND OPTICAL FIBER (OUTSIDE PLANT)

- A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the wall in the proximity of the fiber enclosure.
- B. All cables shall be tagged and identified within the handhole/maintenance hole.
- C. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.
- D. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.
- E. Ventilate maintenance where gas has been detected before entering the maintenance hole.
- F. To ensure that the optical fiber cable's qualities and characteristics are not degraded during installation, excessive pulling tensions and short bending radii will not be allowed. The maximum pulling tension is 600 lbs. The minimum bending radius for cable under tension is 20 times the outside diameter of the cable and for cable at rest is 10 times the outside diameter of the cable.
- G. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.
- H. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.
- I. Contractor shall coil 60 feet of spare optical fiber cable in each handhole/maintenance hole without a splice and 75 feet of optical fiber cable in handholes/maintenance holes with a splice. Cable coils shall have at least two points of support on the optical fiber racking system.
- J. When mounting the optical fiber slack coils, the minimum bend radius shall not be

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exceeded; this radius is equal to 10 times the outside diameter of the cable in a static application and 20 times the outside diameter in a dynamic application. At anytime during the entire handling process of the optical fiber cable, as much care as possible should be maintained and all the manufacturer's recommendations should be followed.

3.05 TERMINATION POINTS

- A. The amount of cable slack at termination points should allow the cable to be routed to the termination location with enough additional cable to reach a convenient location for the polishing, plus an additional 5 meters or to the furthest point in the telecommunications room; whichever is greater.
- B. Termination hardware should be located to allow convenient use, convenient termination, and facilitate routing of additional locations.
- C. When routing cable into an equipment rack/cabinet, the minimum bend radius should be maintained in the transition from the floor or ceiling to the rack or cabinet with the use of flexible conduit and a box end connector.
- D. In equipment racks, the cable should be secured to the frame with Velcro straps to prevent accidental snagging of the cable. The use of innerduct is required.
- E. Optical fiber warning signs should be placed on all innerducts and conduits containing optical fiber cable. Warning signs can help prevent damage resulting from the cable being mistaken for something else.

3.06 INSTALLATION

- A. Yellow or other pulling compound should be used if making long or difficult pulls to reduce cable drag.
- B. When pulling optical fiber cable by any mechanical device (winch etc.) a dynamometer must be used to ensure the maximum tensile strength isn't exceeded.
- C. The mechanical pulling device will be equipped with clutches or shear pins to ensure this.
- D. The fiber cable will be attached to the pull line via the strength member or mesh grip.
- E. At each end of a cable run approximately 5 meters of slack should be left for

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cable repairs, connecting and moving of equipment. Coil up and provide support of any slack fiber on top of the rack or in the designated fiber slack area of the telecommunications room.

3.07 OPTICAL FIBER CONNECTIVITY

- A. Provide and install a "duplex-SC" connector, onto each pair of transmit/receive strands of each end of each cable.
- B. Follow Manufacturer's instructions for installing each connector.
- C. Leave a minimum of 5'-0" of slack of each strand coiled carefully in patch panel tray.

3.08 OPTICAL FIBER SPLICING

- A. All splicing shall be of the fusion type made under Light Injection and Detection Mode, whenever applicable. The Contractor shall provide certified and experienced personnel for splicing.
- B. Contractor's tools and equipment shall be in excellent working order. Any worn or improperly working tools shall be discarded and not used on this project. All fusion splicers shall be calibrated and labeled according to the manufacturer's specifications. Contractor shall submit certification of calibration for the fusion splicers to the Engineer.

3.09 SPLICE CASES

- A. Splice Cases shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.10 ACCESSORIES

- A. Install outer door to complete installation.
- B. Along with above specifications use installation product bulletins which accompany each product.

3.11 IDENTIFICATION

- A. Provide labeling of each cable and each termination. Submit method of labeling for approval. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-13-33

SECTION 27-13-33
COMMUNICATIONS COAXIAL BACKBONE CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Coaxial Backbone Cabling.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of backbone 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.

1.02 SUBMITTALS

- A. Provide product data

1.03 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 Coaxial Backbone Cable (Inside Plant).
 - 2. Furnish and install all Coaxial Backbone Cable (Outside Plant).
 - 3. Furnish and install all Coaxial Connectors.

PART 2 - PRODUCTS

SECTION 27-13-33

2.02 APPROVED PRODUCTS (see attachment “Appendix B” for approved product material list)

- A. Approved Coaxial Backbone Cable (Inside Plant) manufacturer(s):
- B. Approved Coaxial Backbone Cable (Outside Plant) manufacturer(s):
- C. Approved Coaxial Connectivity manufacturer(s):

2.02 COAXIAL BACKBONE CABLE (INSIDE PLANT)

- A. .500" JCAR
 - 1. .500" JCAR cable shall be constructed with a copper clad aluminum conductor, expanded polyethylene dielectric, continuous aluminum outer conductor and a flame retardant polyethylene (PE) jacket.
 - 2. .500" JCAR cable shall be tested and marked to comply with the NEC requirements for (CATVR) Riser Rating.
 - 3. .500" JCAR cable shall be 75-ohm impedance with a nominal attenuation value of 7.91 dB/100m at 1 GHz, or better.

2.03 COAXIAL BACKBONE CABLE (OUTSIDE PLANT)

- A. .500" JCASS
 - 1. .500" JCASS cable shall be constructed with a copper clad aluminum conductor, expanded polyethylene dielectric, continuous aluminum outer conductor and a polyethylene (PE) jacket with floodant compound.
 - 2. .500" JCASS cable shall be 75-ohm impedance with a nominal attenuation value of 7.91 dB/100m at 1 GHz, or better.

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2.04 COAXIAL CONNECTORS

- A. .500" Coaxial Connectivity
 - 1. Connectors shall meet SCTE interface specifications.
 - 2. Nominal impedance shall be 75 ohms.
 - 3. Return loss shall be 30 dB minimum to 1 GHz on pin types, splices and adapters.
 - 4. Insertion loss shall be < 0.15dB (pin types)

PART 3 - EXECUTION

3.01 BACKBONE CABLES (INSIDE PLANT)

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/ -568-C.2 document, manufacturer's recommendations and best industry practices.
- B. Backbone cables shall be installed separately from horizontal distribution cables
- C. 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.
- D. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
- E. CMR rated cables shall be installed in metallic conduit in ALL ceiling and floor spaces.
- F. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- G. Leave 10' of slack on each end of coaxial backbone cable.
- H. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- I. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other

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method to provide proper support for the weight of the cable.

- J. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.
- K. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.
- L. Each coaxial cable shall be clearly labeled on the cable jacket behind the tap/amplifier/directional coupler/splitter 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.

3.02 BACKBONE CABLES (OUTSIDE PLANT)

- A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the backboard.
- B. All cables shall be tagged and identified within the handhole/maintenance hole.
- C. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.
- D. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.
- E. Ventilate maintenance where gas has been detected before entering the maintenance hole.
- F. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.
- G. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.
- H. Coaxial backbone cables shall be bonded and grounded in accordance with the recommendations made in the J-STD-607-A standard, manufacturer's recommendations and best industry practice.

3.03 COAXIAL CONNECTIVITY

- A. Coaxial connectors shall be installed as per the requirements specified by the

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manufacturer's installation guidelines.

- B. Cable preparation and connector application shall be done only with tools approved for use with the connector.

3.04 IDENTIFICATION

- A. Provide labeling of each cable and each termination. Submit method of labeling for approval. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-15-00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Horizontal (distribution) communications wiring and connecting hardware from the Telecommunications Room (TR) to Telecommunication Outlets (TO) throughout the site.

1.2 RELATED DOCUMENTS

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment:
 - A. Section 27-00-00 - Structured Cabling General Requirements
 - B. Section 27-05-10 - Fire stopping
 - C. Section 27-05-26 – Grounding and Bonding for Communications Systems
 - D. Section 27-05-28 – Pathways for Communications Systems
 - E. Section 27-05-43 - Underground Ducts and Raceways
 - F. Section 27-05-53 - Identification
 - G. Section 27-08-00 - Commissioning
 - H. Section 27-11-13 – Entrance Protection
 - I. Section 27-11-16 – Cabinets Racks and Enclosures
 - J. Section 27-11-19 – Termination Blocks and Patch Panels
 - K. Section 27-11-23 – Cable Management and Ladder Racking
 - L. Section 27-11-26 – Rack Mounted Power Strips
 - M. Section 27-13-13 – Copper Backbone Cabling
 - N. Section 27-13-23 – Optical Fiber Backbone Cabling
 - O. Section 27-13-33 – Coaxial Backbone Cabling
 - P. Section 27-15-43 – Faceplates and Connectors
 - Q. Section 27-60-60 – CATV Distribution Equipment

1.3 REFERENCES

- A. All work shall be performed in accordance with the following codes and industry standards, unless noted otherwise:
 - A. NFPA 70 – National Electrical Code, current version adopted by local or State AHJ.
 - B. TIA-568-C.2 – Commercial Building Telecommunications Cabling Standard, current version.
 - C. TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, current version.
 - D. TIA/EIA-606-A – Administration Standard for Commercial Telecommunications Infrastructure, current version.

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- E. J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, current version.
- F. IEEE 241 - IEEE Recommended Practice for Electric Power Systems in Commercial Buildings” pertaining to communication systems.

1.4 SYSTEM DESCRIPTION

- A. The horizontal distribution subsystem refers to all intra-building twisted-pair and fiber optic communications cabling connecting Telecommunication Rooms (TR’s) to telecommunication outlets (TO’s) located at individual work areas.
- B. Horizontal cabling may consist of a combination of the following types of cable from the TR to the TO:
 - A. Category 6 (100 Ohm, 4-pair, unshielded twisted pair) cables from the TR’s to the TO’s.)
 - B. Category 6 (100 Ohm, 4 pair, shielded, twisted pair) cables from the TR’s to the TO’s.)
- C. The Horizontal System includes cables, jacks, patch panels, connecting blocks, patch cords, fiber connectors and jumpers as well as the necessary support systems, such as cable managers and faceplates.
- D. Cables shall be routed through conduit, cable trays, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile, and through plenum air-handling spaces above ceiling tile. Coordinate with General Contractor (GC).
- E. Cables shall not be attached to ceiling grid, fire sprinkler systems, duct work, or lighting fixture supports or cables. Where support is required the contractor shall install appropriate support systems as prescribed in ANSI/TIA-568.C.2.
- F. Cables shall be installed in continuous lengths from origin to destination point. There shall be no splices.
- G. Horizontal cables shall not be bundled in groups of more than 50 cables.
- H. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 Lbs) shall be installed with any cable installed in conduits. A pull cord is not required for conduit sleeves, of less than 4’ in length.
- I. Contractor shall leave a minimum of 12” of slack for twisted pair out the outlet end. This slack shall be neatly coiled in the wall, termination box, or modular furniture raceway. Where there is insufficient space in the wall, termination box, or modular furniture raceway, the required slack may be left loosely coiled in the ceiling area.
- J. Each cable shall be clearly labeled on the cable jacket behind the termination device at each location.

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- K. Telecommunications contractor shall furnish and install all materials necessary for a complete and working system.

1.5 WARRANTY

- A. The Telecommunications / Networking contractor must be an approved Ortronics (Legrand) Certified Contractor at a Plus tier (CIP, CIP-ESP) and able to provide nCompass warranty A copy of certification documents must be submitted with the quote in order for such quote to be valid., CIP-Platinum, or multi-site/national) . The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the all manufacturer guidelines. Ortronics / Superior Essex (nCompass) will extend a Limited Lifetime or 25 year warranty to the End User for projects completed upon receipt of test results.
- B. All necessary documentation for warranty registration must be provided to Ortronics and Georgia State University Information Systems and Technology Group and will be furnished by the Telecommunications Contractor immediately following 100% testing of all cables. All test results shall be submitted to Ortronics and Georgia State University Information Systems and Technology Group in the certification tester's original software on CD.
- C. Telecommunications Contractor shall administer the warranty process with the responsible manufacturer's representative. The warranty shall be provided directly to the owner from the manufacturer. Telecommunications contractor shall insure that the manufacturer provides the Owner (Georgia State University Information Systems and Technology Group), with the appropriate warranty certification within 30 calendar days of the final project completion.

PART 2 - PRODUCTS

2.1 APPROVALS AND SUBSTITUTIONS

- A. All products shall be provided as specified, without exception, unless approved in writing by Georgia State University Information Systems and Technology Group prior to the bid.
- B. Non-compliant products installed as a part of this Contract shall be removed and replaced and all costs for removal and replacement shall be borne solely by the Contractor(s).
- C. All products shall be "NEW".

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2.2 STATION CABLING

- A. Approved Copper Station Cable Manufacturer(s):
 - 1. Superior Essex

2.3 ACCEPTABLE STATION CABLING TYPES

- A. Category 6 unshielded twisted pair
 - a. 100 ohm, Category 6, 23AWG, 4-pair unshielded twisted pair, CMP rated, color blue.
 - b. The horizontal balanced twisted pair cable shall meet or exceed the Category 6 transmission characteristics per ANSI/TIA-568-C.2.
- B. Category 6 shielded twisted pair
 - a. 100 ohm, Category 6 SFTP, 23 AWG, 4-pair shielded twisted pair, CMP rated, color gray
 - b. The horizontal balanced twisted pair cable shall meet or exceed the Category 6 transmission characteristics per ANSI/TIA-568-C.2.

3.1 EXECUTION

- 1. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- 2. 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.
- 3. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type.
- 4. Cables shall be installed in continuous lengths from origin to destination (no splices).
- 5. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.
- 6. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- 7. Horizontal distribution cables shall be bundled in groups of no more than 50 cables.
- 8. 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.

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COMMUNICATIONS COAXIAL HORIZONTAL CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 Coaxial 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.

1.02 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

1.03 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:

SECTION 27-15-33

1. Furnish and install all Horizontal Coaxial Cable.

PART 2 - PRODUCTS

2.03 APPROVED PRODUCTS (see attachment "Appendix B" for approved product material list)

- A. Approved Horizontal Coaxial Cable manufacturer(s):

2.02 HORIZONTAL COAXIAL CABLE

A. SERIES RG6 COAX

1. Series-6 coaxial cable shall be used for horizontal runs less than 200'.
2. Series-6 coaxial cable shall be 75-Ohm impedance with a nominal attenuation value of less than 29dB/100m at 1 GHz for CMP rated jacket.
3. Cable construction shall be 18 AWG solid-copper or copper-clad steel center-conductor and foam FEP dielectric. Cables shall be provided with 60% / 40% quad shields with braid constructed of aluminum or tinned copper wire.
4. Cable jacket shall be CMP rated.

B. SERIES RG11 COAX

1. Series-11 coaxial cable shall be used for horizontal runs that exceed 200'.
2. Series-11 coaxial cable shall be 75-Ohm impedance with a nominal attenuation value of less than 21dB/100m at 1 GHz for CMP rated jacket.
3. Cable construction shall be 14 AWG solid-copper or copper-clad steel center-conductor and foam FEP dielectric. Cables shall be provided with 60% / 40% quad shields with braid constructed of aluminum or tinned copper wire.
4. Cable jacket shall be CMP rated.

PART 3 - EXECUTION

3.01 HORIZONTAL CABLES

- A. Cable shall be installed in accordance with manufacturer's recommendations and best

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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.
- 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. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. Cables shall be dressed and terminated in accordance with the recommendations

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made in the ANSI/TIA-568-C.2 document, manufacturer's recommendations and best industry practices.

- M. Leave a minimum of 12" of slack for coax 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.
- N. 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.
- O. 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.

3.02 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-15-43

SECTION 27-15-43

COMMUNICATIONS FACEPLATES & CONNECTORS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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.

1.02 RELATED DOCUMENTS

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment:
 - A. Section 27-00-00 - Structured Cabling General Requirements
 - B. Section 27-05-10 - Fire stopping
 - C. Section 27-05-26 – Grounding and Bonding for Communications Systems
 - D. Section 27-05-28 – Pathways for Communications Systems
 - E. Section 27-05-43 - Underground Ducts and Raceways
 - F. Section 27-05-53 - Identification
 - G. Section 27-08-00 - Commissioning
 - H. Section 27-11-13 – Entrance Protection
 - I. Section 27-11-16 – Cabinets Racks and Enclosures
 - J. Section 27-11-19 – Termination Blocks and Patch Panels
 - K. Section 27-11-23 – Cable Management and Ladder Racking
 - L. Section 27-11-26 – Rack Mounted Power Strips
 - M. Section 27-13-13 – Copper Backbone Cabling
 - N. Section 27-13-23 – Optical Fiber Backbone Cabling
 - O. Section 27-13-33 – Coaxial Backbone Cabling
 - P. Section 27-15-00 – Communications Horizontal Cabling
 - Q. Section 27-60-60 – CATV Distribution Equipment

SECTION 27-15-43

1.03 SUBMITTALS

- A. Provide the following submittals:
 - 1. Product data
 - 2. Sample of each outlet correctly configured.

1.04 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 Coaxial Connectivity.
 - 3. Furnish and install all Faceplates.
 - 4. Furnish and install all Surface Mount Boxes.

PART 2 - PRODUCTS

2.01 Approved Products (see attachment "Appendix B" for approved product material list)

- A. Approved Single-Gang Faceplates for in wall and Surface-Mount Installations:
 - 1. Manufacturer: Ortronics
 - 2. TrackJack 2 Port Faceplate Part Number: OR-40300548
 - 3. TrackJack 4 Port Faceplate Part Number: OR-40300546
 - 4. Color: Fog White
- B. Approved Modular Furniture Faceplate:
 - 1. Manufacturer: Ortronics
 - 2. TrackJack Furniture Faceplate Part Number: OR-40300633
 - 3. Color: Fog White
- C. Approved Faceplate Blanking Modules
 - 1. Manufacturer: Ortronics
 - 2. TrackJack Blank Insert Part Number: OR-42100002
 - i. (Part # for 10 Pack)

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3. Color: Fog White

D. Approved Single-Gang Surface Mount Box

1. Manufacturer: Ortronics
2. TrackJack 2 Port Surface Mount Box Part Number: OR-404TJ2
3. TrackJack 4 Port Surface Mount Box Part Number: OR-404TJ4
4. Color: Fog White

E. Approved Category 6 Unshielded Cable, Faceplate Module:

1. Manufacturer: Ortronics
2. TrackJack Cat6 Jack Part Number: OR-TJ600
3. Color: Fog White

F. Approved Category 6 Shielded Cable, Faceplate Module:

1. Manufacturer: Ortronics
2. TrackJack Cat6 Jack Part Number: OR-TJS600
3. Color: Fog White

G. Approved RG6 BNC Connector Coaxial Faceplate Insert:

1. Manufacturer: Ortronics:
2. TrackJack BNC Insert: Part Number: OR-KSBNC
3. Color: Fog White

2.02 COAXIAL CONNECTIVITY

- A. Connectors shall be solderless, 75-Ohm impedance and be designed for the specific type of cable used.
- B. Series-6 connectors shall be one piece.
- C. All Series-6 connections shall be made with compression-type connectors.
- D. Screw-on connectors are not acceptable.
- E. The coaxial adapter module that occupies the faceplate shall be a 75-ohm, BNC-type connector.

2.03 FACEPLATES

SECTION 27-15-43

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 fog white.

B. Blank Insert: Color shall be fog white.

2.04 SURFACE MOUNT BOXES

- A. The surface mount box shall accommodate voice, data 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 fog white.

PART 3 - EXECUTION

3.01 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).

3.02 COAXIAL CONNECTIVITY

- A. BNC-connectors shall be installed in accordance with

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manufacturer's recommendations and installation guides, and best industry practices.

- B. Cable connector application shall only be done using a manufacturer approved gas- less compression crimping tool.

3.03 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.

3.04 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.

3.05 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

SECTION 27-60-10

CATV DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Applicable requirements of Division 27 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 CATV Distribution Equipment Requirements.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of CATV distribution 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.

1.02 SUBMITTALS

- A. Provide product data

1.03 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 Distribution Amplifiers.
 - 2. Furnish and install all Line Extenders.
 - 3. Furnish and install all Taps.
 - 4. Furnish and install all Line Splitters/Directional Couplers.
 - 5. Furnish and install all Power Inserters.
 - 6. Furnish and install all Drop Splitters.

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7. Furnish and install all Fiber Nodes.
8. Furnish and install all Fiber Transmitters
9. Furnish and install all Fiber Splitters
10. Furnish and install and Bulkhead Panels.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

- A. Approved Distribution Amplifier manufacturer(s):
 1. Scientific Atlanta
 2. Or Approved Equal
- B. Approved Line Extender manufacturer(s):
 1. Scientific Atlanta
 2. Or Approved Equal
- C. Approved Tap manufacturer(s):
 1. Scientific Atlanta
 2. Or Approved Equal
- D. Approved Line Splitter/Directional Coupler manufacturer(s):
 1. Scientific Atlanta
 2. Or Approved Equal
- E. Approved Power Inserter manufacturer(s):
 1. Scientific Atlanta
 2. Or Approved Equal
- F. Approved Drop Splitter manufacturer(s):
 1. Regal
 2. Signal Vision
 3. ASKA
 4. Or Approved Equal
- G. Approved Fiber Receiver Node manufacturer(s):

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1. Olson
 2. Or Approved Equal
- H. Approved Fiber Transmitter manufacturer(s):
1. Olson
 2. Or Approved Equal
- I. Approved Fiber Splitter manufacturer(s):
1. Olson
 2. Or Approved Equal.
- J. Approved Bulkhead Panel manufacturer(s):
1. AVP
 2. Canare
 3. Or Approved Equal.

2.02 DISTRIBUTION AMPLIFIERS

- A. Distribution amplifiers shall be Scientific Atlanta, GainMaker, High Gain Dual System Amplifier, 870 MHz with 40/52 MHz Split.
- B. Distribution amplifier shall feature:
1. Common RF test points for forward output and reverse injection.
 2. Fixed value plug-in accessories.
 3. 60 and 90 volt AC powering capability.
 4. 15 ampere current capacity.
 5. Thermal backup on automatic gain control.
 6. Plug-in, self-contained duplex filters.
 7. Modular high-efficiency power supply.
 8. Reverse input pad and RF test point.
 9. Directional coupler RF test points.
 10. Surge resistant circuitry.
- C. Performance Specifications:
1. Pass Band
52-870 MHz Forward
8-40 MHz Reverse

SECTION 27-60-10

- | | | |
|----|------------------------|--|
| 2. | Return Loss | 16 dB |
| 3. | Reference Output Level | 47.5 dBmV @ 870 MHz
45.7 dBmV @ 750 MHz
35 dBmV @ 55 MHz |
| 4. | Reference Output Tilt | 12.5 dB (55-870 MHz) |
| 5. | Channel Loading | 110 NTSC (CW) with digital |

2.03 LINE EXTENDERS

A. Line extender shall be Scientific Atlanta, 870 MHz with 40/52 MHz Split.

B. Line extender shall feature:

1. Common RF test points for forward output and reverse injection.
2. Fixed value plug-in accessories.
3. 60 and 90 volt AC powering capability.
4. 15 ampere current capacity.
5. Thermal backup on automatic gain control.
6. Plug-in, self-contained duplex filters.
7. Modular high-efficiency power supply.
8. Reverse input pad and RF test point.
9. Directional coupler RF test points.
10. Surge resistant circuitry.

C. Performance Specifications:

- | | | |
|----|------------------------|--|
| 1. | Pass Band | 52-870 MHz Forward
8-40 MHz Reverse |
| 2. | Return Loss | 16 dB |
| 3. | Reference Output Level | 47.5 dBmV @ 870 MHz Forward
45.7 dBmV @ 750 MHz Forward
35 dBmV @ 55 MHz Forward |
| 4. | Reference Output Tilt | 12.5 dB (55-870 MHz) |
| 5. | Channel Loading | 110 NTSC (CW) with digital |

2.04 LINE SPLITTERS / DIRECTIONAL COUPLERS

A. Line splitter / directional coupler shall be Scientific Atlanta, 1 GHz passive.

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- B. Line splitter / directional coupler shall feature:
 - 1. AC bypass coil.
 - 2. Power passing/blocking jumpers.
 - 3. Powder coated paint.
- C. Performance Specifications:

1. Frequency Range	5 MHz to 1000 MHz
2. Return Loss	18 dB minimum 20 dB typical
3. Tap Loss (directional couplers)	+/- 1 dB
4. Hum Modulation @ 10 amps	70 dB average
5. Power Passing	10 A, 60/90 V ac, 50/60 Hz

2.05 POWER INSERTERS

- A. Power inserter shall be Scientific Atlanta, 1 GHz passive.
- B. Power inserter shall feature:
 - 1. AC bypass coil.
 - 2. Power passing/blocking jumpers.
 - 3. Powder coated paint.
- C. Performance Specifications:

1. Frequency Range	5 MHz to 1000 MHz
2. Return Loss	18 dB minimum 20 dB typical
3. Hum Modulation @ 10 amps	70 dB average
4. Power Passing	15 A, 60/90 V ac maximum input 10 A, 60/90 V ac maximum output

2.06 TAPS

- A. Tap shall be Scientific Atlanta 1 GHz.
- B. Tap shall feature:

SECTION 27-60-10

1. Polymer coating for environmental protection.
2. Sealed extended F-ports to protect against moisture.
3. Tin-plated brass F-ports.

C. Performance Specifications:

- | | | |
|----|--------------------------|---|
| 1. | Frequency Range | 5 MHz to 1000 MHz |
| 2. | Return Loss | 15 dB minimum, 5-10 MHz
19 dB minimum, 10-400 MHz
15 dB minimum, 400-1000 MHz |
| 3. | Tap-To-Tap Isolation | 20 dB minimum, 5-10 MHz
24 dB minimum, 10-500 MHz
22 dB minimum, 500-750 MHz
18 dB minimum, 750-1000 MHz |
| 4. | Hum Modulation @ 10 amps | 70 dB average |
| 5. | Power Passing | 6 A, 60 V ac, 50/60 Hz |

2.07 DROP SPLITTERS

- A. Splitters shall be of the totally shielded type, using a sealed metal or aluminum case, so as to minimize re-radiation and ingress. Splitters shall be equipped with grounding screws/connectors. All connections will be "F" type connections.

1. Frequency range shall be 5 MHz to 1 GHz.

2.08 FIBER RECEIVER NODE

- A. Fiber RECEIVER nodes will be designed for forward path bandwidth from 54 MHz - 870 MHz. The fiber receiver node shall include a provision which provides for the addition of a return optical transmitter for two-way transmission.

Input Range:	-6dBm to 3 dBm
Output Level:	48 dBmv @ 550 MHz
Return Loss:	16 dB
Optical Connector:	SC/APC Standard
RF Connector:	Type F

2.09 FIBER TRANSMITTERS

- A. Fiber transmitters will be designed with a bandwidth range of 48 - 870MHz. The device shall be equipped with external RF and optical test points for circuit set-up and maintenance.

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Input Level:	18 dBm
Optical Output Level:	3, 6, 8, 10, 12, 14 or 15 dBm
Return Loss:	15 dB
Optical Connector:	SC/APC Standard
RF Connector:	Type F

2.10 OPTICAL SPLITTERS

- A. Optical splitter shall be 1 x 4 configuration. These devices shall accept SC or APC optical fiber connectors.

2.11 BULKHEAD PANELS

- A. Bulkhead panels shall be pre-loaded with female-to-female, 75-ohm f-connectors. Snap-in, modular-type, multi-media panels are not allowed. Bulkhead panels shall be constructed of steel. Color shall be black.

PART 3 - EXECUTION

3.01 CATV DISTRIBUTION EQUIPMENT

- A. CATV distribution equipment shall be installed as per the requirements specified by the manufacturer's installation guidelines and best industry practice.
- B. Signal level at each outlet will be +5 dBmv, +/- 3 dB.
- C. CATV distribution equipment shall be bonded and grounded in accordance with the recommendations made in the ANSI/TIA-607-C standard.

3.02 IDENTIFICATION

- A. Refer to section 27 05 53 for labeling details.

END OF SECTION

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VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section covers video surveillance systems.
- B. The video surveillance system shall consist of an expansion of the existing GSU video surveillance system (Ocularis). Provide any additional camera and/or software licenses required to expand the existing system.
- C. The video surveillance system shall consist of IP (TCIP compatible) video cameras viewable on video surveillance workstations via connected to a local area network.

1.02 QUALITY ASSURANCE

- A. Installation of the video surveillance system shall be under the direct supervision of a person or persons having completed, as a minimum, the factory training recommended by the system manufacturer, the manufacturer's highest available certification program, and have direct field experience in the installation of a minimum 3 project of similar complexity and size within the past 5 years.
- B. The installation company shall be a currently listed as an authorized dealer or business partner by the manufacturer of the system provided and shall have been listed as such for a minimum of 3 years.
- C. In addition, the installation company shall have at the minimum two permanently employed persons with current system certification in their field office directly responsible for the installation and ongoing maintenance of the project. The office shall be located within a 100 m radius of the project.

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PART 2 - PRODUCTS

2.1 VIDEO CAMERAS AND ACCESSORIES

A. Video cameras shall have the following minimum features:

1. Signal and scanning systems: NTSC color.
2. Image sensor: progressive scan CCD or CMOS sensor, ½.9" or larger.
3. Operating range: indoor cameras shall have an operating range from 14°F to 122°F; outdoor cameras shall have an operating range from -22°F to 122°F.
4. Signal-to-noise ratio: 50 dB (automatic gain control off).
5. Minimum illumination (unless otherwise noted herein): for indoor cameras, 0.1 fc (F1.6) in color mode; for outdoor cameras, 0.1 fc (F1.6) in color mode, 0.01 fc (F1.6) in monochrome mode. Provide day/night (color/monochrome with IR filter removal) type cameras for outdoor areas.
6. For day/night cameras: mechanical day/night filter.
7. Digital processing with automatic white balance, automatic gain control, electronic shutter control, and backlight compensation.
8. Event triggers: video motion detection (internal), active tampering alarm, and external input.
9. Event actions: pre- and post-alarm video buffering, and activation of (relay) external output.
10. Analog cameras shall meet the following minimum requirements:
 - a. Dynamic range: 54 dB/128X
 - b. Power: 12V DC or 24V AC, autosensing
11. IP type video surveillance cameras shall meet the following minimum requirements:
 - a. Dynamic range: minimum 65 db, except camera types specified to have wide dynamic range shall have a minimum of 100 dB dynamic range.
 - b. Network interface: Ethernet 1000 BaseT.
 - c. Supported protocols: TCP/IP, UDP/IP, DHCP, HTTP, Multicast, PPPoE, RTP, and RTSP.
 - d. Security: SSL-based authentication.

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- e. ONVIF compliant, profile S (www.onvif.org).
 - f. Compression: H.264 Baseline and Main Profile (MPEG-4 Part 10/AVC) and Motion JPEG, each stream independently selectable and capable of being transmitted to separate locations.
 - g. VBR (variable bitrate) or CBR (constant bitrate) encoding format selectable to correspond with various network conditions.
 - h. External I/O terminals: alarm input, alarm output.
 - i. Event triggers: video motion detection (internal), active tampering alarm, and external input.
 - j. Event actions: video recording to edge storage, audio recording to edge storage, pre- and post-alarm video buffering, and activation of (relay) external output.
 - k. Power: IEEE 802.3af-2012 or IEEE 802.3at-2012 compliant PoE.
 - 1) Exterior fixed position minidome cameras with integral heater/blower shall be PoE compliant.
 - 2) Pan-tilt-zoom type cameras shall also be capable of operation via 24 V AC power.
- B. Pan-tilt drives (for remotely positional cameras) shall have the following minimum features:
- 1. Pan movement: 360° continuous pan rotation.
 - 2. Vertical tilt: unobstructed 85°.
 - 3. Manual pan-tilt speed: 100° per second.
 - 4. Preset pan-tilt speed: 400° per second.
 - 5. Capable of 64 presets.
 - 6. Auto-flip feature that rotates the camera 180° at the bottom of tilt travel.
- C. Camera Enclosures and Mounting Hardware:
- 1. For cameras located in environmentally controlled areas (indoors) enclosures and mounting hardware shall have the following minimum features:
 - a. Compatible with the camera and lens provided.
 - b. IK08 rated for impact resistant.
 - 2. For each camera located in environmentally uncontrolled areas (outdoors) enclosures and appropriate mounting hardware shall have the following

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minimum features:

- a. Compatible with the camera, lens, and pan-tilt drive provided.
- b. IP66 or NEMA 4X rated enclosure.
- c. IK10 rated for impact resistant.
- d. Integral heater where cameras exposed to wind and ice are not rated for -22°F or lower; or where outdoor temperatures below -22°F have been recorded.
- e. Sunshield where the video camera is exposed to direct sun.
- f. Integral blower.

D. Additional Video Camera Requirements for Specific Camera Types:

1. Type 1: Interior Minidome, 1080p resolution:

- a. Minimum resolution 2.1 megapixel – capable of 1920 x 1080 image size
- b. Minimum focal length 2.8mm
- c. Minimum focal ratio F2.0
- d. Minimum horizontal viewing angle 113°
- e. H.264 compression
- f. IEEE802.3af – Power over Ethernet
- g. Network interface: 10BASE-T / 100BASE-TX (RJ-45)
- h. Operating Temperature -13 °F to +122 °F (-25°C to +50°C)

2. Type 2: Exterior Minidome, 1080p resolution:

- a. Minimum resolution 2.1 megapixel – capable of 1920 x 1080 image size
- b. Minimum focal length 2.8mm
- c. Minimum focal ratio F2.0
- d. Minimum horizontal viewing angle 113°
- e. H.264 compression
- f. IEEE802.3af – Power over Ethernet
- g. Network interface: 10BASE-T / 100BASE-TX (RJ-45)
- h. Operating Temperature -22 °F to +140 °F (-10°C to +50°C)

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3. Type 3: Interior/exterior, remotely pan tilt zoom (PTZ)
 - a. Minimum resolution 3.0 megapixel – capable of 1920 x 1080 image size
 - b. Minimum focal length 4.7 to 94.0mm
 - c. Minimum focal ratio F1.6 to F3.5
 - d. Minimum Optical zoom 20x, Digital zoom 12x, Total zoom 240x
 - e. Minimum pan angle 360°
 - f. Minimum speed 300°
 - g. Minimum tilt angle 210°
 - h. Minimum tilt speed 300°
 - i. Day and Night
 - j. H.264 compression
 - k. IEEE802.3af – Power over Ethernet
 - l. Network interface: 10BASE-T / 100BASE-TX (RJ-45)
 - m. Operating Temperature 23 to 122°F (-5 to +50 °C)

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide programming for complete systems integration
- B. Systems shall be installed by skilled craftsmen in a manner conforming to industry standards for the craft.

3.2 VIDEO CAMERAS AND ACCESSORIES

- A. Provide Video cameras: connect camera video analytics alarm output to the access control system alarm input module as required for alarm event logging and response.
- B. Pan-tilt drives: program presets as required for coverage of the detection devices, sensors, and alarm zones indicated on the Drawings.

END OF SECTION

APPENDIX A: TELECOMMUNICATIONS ROOM

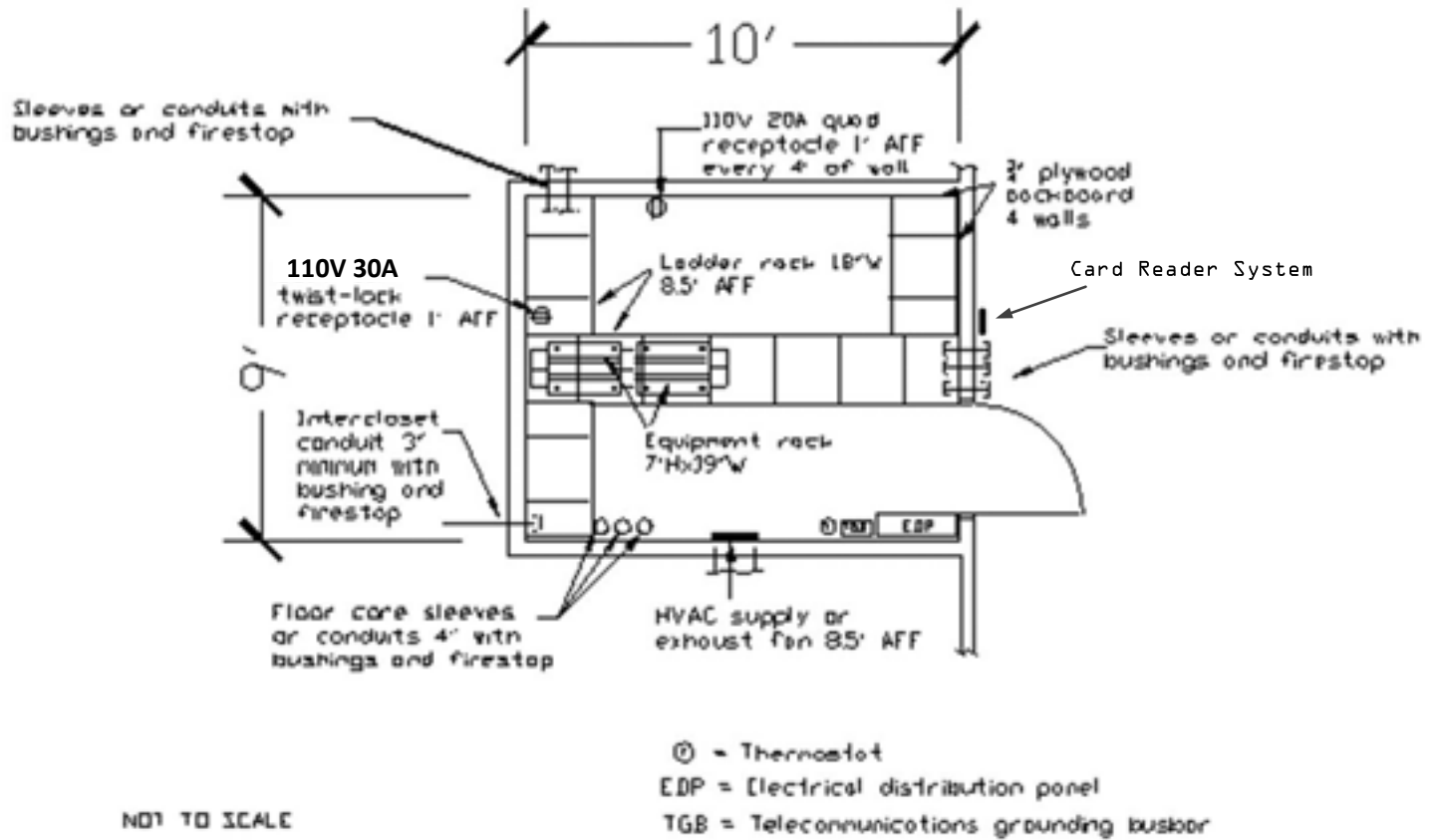
APPENDIX A: TELECOMMUNICATIONS ROOM

1. To minimize horizontal cable lengths (maximum of 295 ft.), locate the TR as close as possible to the center of, and on the same floor as the area it is intended to serve, minimum TR size is 10' x 8'. Ensure that TR is accessible from a hallway or other common area, TR's in multifloor buildings should be stacked vertically.
2. Equipment not related to the support of the Telecommunication Room (e.g., piping, duct work, and distribution of building power) should not be located in, or pass through, the TR.
3. The Telecommunications Room may not be shared with building or custodial services that may interfere with the telecommunications systems. For example, mop sinks and cleaning materials (e.g., mops, buckets, solvents) or general building maintenance supplies (e.g., ladders, fluorescent tubes, paint.).
4. Telecommunications Rooms shall not have doorsills or center posts (must be removable). The door shall be fully opening (to 180 degrees recommended) and at least 36-in W x 80-in H and installed with a lock and a card reader system. GSU Key Control must be notified and coordinated with for the lock. The specifications for the card reader system are found in section 28 10 00 Electronic Access Control and Intrusion Detection of the GSU Architectural and Engineering Design Standards document.
5. Carpet is not permitted in any telecommunications rooms. Floors shall be lacquer finished or static-controlled.
6. The minimum ceiling height shall be 8' AFF. Consideration should be given to having a 10' height. False ceilings are not permitted in Telecommunications Rooms unless an in-floor distribution system is used.
7. All walls of the TR shall be constructed from floor to structure and lined with rigidly installed, wall to wall framing of Trade Size ¾-inch A-C plywood, 8-ft high. And painted with a non-conductive fire-retardant overcoat. Each section should have a section not painted to allow the inspector to see that the plywood is flame retardant.
8. Sleeves that extend from floor cores shall extend 1" to 4" AFF.
9. All sleeves shall be firestopped in accordance with applicable building codes.

APPENDIX A: TELECOMMUNICATIONS ROOM

10. Equipment racks/cabinets and cable trays shall be secured grounded and bonded.
11. Provide a bond with a minimum of a #2 AWG, green insulated ground wire from the Telecommunications Grounding Busbar (TGB) to the main electrical service building ground. TGB shall be solid copper ¼"x 4"x 13.5" in size.
12. Conduits located in the ceiling shall protrude 2-in into the closet and be furnished with bushings to protect the cable.
13. TR temperatures shall be maintained between 50-80 degrees Fahrenheit, with a relative humidity of 30% to 55%.
14. Ventilation shall accomplish one (1) air change per hour, by a thermostatically controlled exhaust fan.
15. TR shall have a rated minimum floor loading of 50lb/ft-sq.
16. Lighting intensity shall be at least 50 footcandles, 3' AFF. Coordinate closely with rack placements. Locate light fixtures a minimum of 8.5' AFF. Emergency lighting is recommended.
17. TR shall have a minimum of one (1) 120V AC quad receptacle for every 4' of running wall, located at least 6" AFF. Provide one (1) 20A circuit for every two (2) quad receptacles. Provide one (1) 30A 110V AC twist lock receptacle (L5 -30R).
18. TR may also include one (1) convenience outlet 120V AC, 20 A.
19. TVSS, dedicated Telecommunications Room circuit panels (no motors, lights etc.), K-rated transformers (K-factor of 7), 100% neutrals, no isolated ground (IG) receptacles

APPENDIX A: TELECOMMUNICATIONS ROOM



APPENDIX B: APPROVED PRODUCTS

APPENDIX B: APPROVED PRODUCTS

***Part numbers provided are minimum requirements.

Product Description	Manufactures	Part numbers	NOTES
48 port patch panels (cat6)	Ortronics	OR-PHD66U48	Loaded
24 port Patch panel (SFTP shielded)	Ortronics	OR-401045604	Unloaded 24 port, just use shielded Track Jack (PJ) jacks for the IDF/MDF side
2 port FacePlates (single gang)	Ortronics	OR-40300548	*Color: Fog White / TrackJack series
4 port FacePlates (single gang)	Ortronics	OR-40300546	*Color: Fog White / TrackJack series
Modular Furniture Faceplate	Ortronics	OR-40300633	*Color: Fog White / TrackJack series
Blanking Modules	Ortronics	OR-42100002	*Color: Fog White / TrackJack series
2 port Surface Mount Box (single gang)	Ortronics	OR-404TJ2	*Color: Fog White / TrackJack series
4 port Surface Mount Box (single gang)	Ortronics	OR-404TJ4	*Color: Fog White / TrackJack series
Category 6 unshielded Jack	Ortronics	OR-TJ600	*Color: Fog White / TrackJack series
Category 6 Shielded Jack	Ortronics	OR-TJS600	*Color: Fog White / TrackJack series
RG6 BNC Connector coaxial faceplate insert	Ortronics	OR-KSBNC	*Color: Fog White / TrackJack series
1 RU fiber enclosure	Ortronics	OR-FC01U-P	Holds 3 inserts (with 12 port inserts this gives you 36 ports)
	Corning	CCH-01U	Holds 2 inserts
	AFL	FM002711-BE	Holds 3 adapter plates or splice modules
2 RU fiber enclosure	Ortronics	OF-FC02U-P	Holds 12 inserts (with 12 port inserts this gives you 144 ports)
	Corning		
	AFL		
4 RU fiber enclosure	Ortronics	OR-FC04U-P	Holds 12 inserts (with 12 port inserts this gives you 384 ports)
	Corning	CCH-04U	Holds 12 inserts
	AFL		
MM fiber insert panel: 6 port SC	Ortronics	OR-OFP-SDC06LC	OM3/4
	Corning		
	AFL		
SM fiber insert panel: 6 port SC	Ortronics	OR-OFP-SCD06AC	
	Corning		
	AFL		
MM fiber insert panel: 12 port SC	Ortronics	OR-OFP-SCD12LC	
	Corning	CCH-CP12-E7	
	AFL		

APPENDIX B: APPROVED PRODUCTS

SM fiber insert panel: 12 port SC	Ortronics	OR-OFP-SCD12AC		
	Corning	CCH-CP12-59		
	AFL			
Blank	Ortronics	OR-OFP-Blank		
	Corning			
	AFL			
Copper Inside Plant (CMP)				
Cat 6	Superior Essex	66-240-2B		* min 6 not accepted by end user, must be DataGain or higher
Cat 6A	Superior Essex	6B-272-2B		* Specific 10 Gain part number to be used for GSU
Copper OSP	Superior Essex			
	Belden			
Fiber Inside Plant	Superior Essex (Corning Glass)			
	Corning			
	AFL			
Fiber Connectors				
Mechanical (Field Installable): SC Multimode	Ortronics	OR-205KNT9FA-50T		
	Corning	95-050-41-X		
	AFL			
Mechanical (Field Installable): SC Singlemode	Ortronics	OR-205KNT9RA-09		
	Corning			
	AFL	Fast-SC-SM-6		
Splice Case	Ortronics			
	Corning			
	AFL			
Wall mounted s110				
50 pair	Siemon	S110AW1-50		
100 pair	Siemon	S110AW2-100		
200 pair	Siemon	S110AW2-200		
300 pair	Siemon	S110AW2-300		
Wall –Mounted S110 Horizontal Cable Managers	Siemon	S110A1RMS		
Horizontal Cable Management	Ortronics	SHMC2RU		
	Optical Cable Corp (occ)	COMB3519		
Vertical Cable Management (double sided)	Ortronics	QVMD706		

APPENDIX B: APPROVED PRODUCTS

	Chatsworth Products inc	11729-503		
Vertical Cable Management (single sided)	Ortronics	QVMS706		
Ladder Rack Systems	Chatsworth Products, Inc			
	B-Line			
Velcro Strap Manufacturers	Ortronics			
	Panduit			
C-Ring / D-Ring	Simon	S144		
Power Strip Manufacturers	Chatsworth Products, Inc			
	TrippLite			
	Ditek			
	Geist			
Coaxial Inside Plant	Superior Essex			RG6
	CommScope			
	Approved Equal			
Coaxial Outside Plant	Superior Essex			
	CommScope			
	Approved Equal			
Coaxial Connectivity	Gilbert			
	Approved Equal			
Standard Equipment manufacturer(s)	Chatsworth Products, Inc	55053-503		
Cabinet manufacturer(s)	Chatsworth Products, Inc	13761-197		
Equipment Shelf Manufacturer(s)	B-Line	SB-596-19-DTG		

END OF SECTION



Appendix D

Audio Visual Systems Contractor Standards and Guidelines

Prepared By
Instructional Innovation and Technology

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Overview

The purpose of this document is to communicate the technical standards set by Instructional Innovation and Technology (IIT) when developing or renovating general schedule classroom environments. This document is to be used as a general guide for classroom technology as set forth by the central IIT staff using best practices for teaching and learning, industry standards, and community feedback. It is intended to promote effective, reliable, and cost-sensitive learning environments that provide students, faculty, and staff with the best experience possible.

Instructional Innovation and Technology is dedicated to providing the best overall physical, logical, programming, security, and compliance needs for a successful classroom installation by any contractor or outside entity. This document is to be used on all general scheduled classrooms (those controlled by the Georgia State University registrar) or spaces that are supported by IIT. Any deviation from this document must be cleared by IIT Learning and Production Environments staff and reviewed with any corresponding stakeholders.

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Definitions

GSU - Georgia State University

IIT – Instructional Innovation and Technology. Responsible for University standards for Audio Visual design.

IIT – Instructional Innovation and Technology. Parent organization to the Learning Innovations team and the main IT organization at GSU.

ADA - American's with Disabilities Act

AFF - Above Finished Floor

ANSI - American National Standards Institute

Audio Visual Integrator - A company or person contracted by IIT to perform work within Georgia State University

Dante - Digital Audio Network Through Ethernet (software and hardware to deliver uncompressed and multi-channel audio over ethernet)

DM - Crestron's proprietary audio/video/control transversal over Category cable.

DSP - Digital Sound Processor

DTP - Extron's proprietary audio/video/control transversal over Category cable.

EDID - Extended Display Identification Data (data structure used to describe the capabilities of a given source)

HDBaseT/HDBT - Consumer electronic and commercial connectivity standard for transmission of uncompressed HD video over Category cable

HDCP - High-Bandwidth Digital Content Protection

HDMI - High Definition Multimedia Interface

InfoCOMM - Also known as Avixa, is a trade association representing the professional audiovisual communication industry

IPBaseT - Internet Protocol based connectivity similar to HDBaseT

IWS – Instructor Workstation

NFPA - National Fire Protection Association

POE - Power over Ethernet

RU – Rack Unit (equivalent to 1.75 inches of vertical space)

SANS - Institute for information security standards

SDVOE - Software Defined Video Over Ethernet

TIA - Telecommunications Industry Association

VTC – Video Teleconferencing

XTP - Extron's proprietary audio/video/control transversal over Category cable.

Revision History

Revision	Description / Changes	Date
0	Initial creation of document	2/12/2018
1	Added Required Hardware	4/15/2018
2	Updated Equipment Standards	12/05/2019
3	Updated Equipment Standards	2/21/2022

Methodology

The following sections detail the methodologies used in creating this document and any other supporting texts. IIT's focus in the creation of classrooms is to take a holistic design approach to effective learning environments. IIT uses a mix of frameworks and technologies when choosing what components within a classroom will be implemented as standards. IIT focuses heavily on current teaching and learning research to influence the direction and understand the efficacy of technology-based learning environments. Research that supports student engagement strategies are outlined below.

Teaching and Learning

Modern research has shed light on the role learning environments play into efficacy of teaching and learning. IIT both learns from and contributes to the growing body of research around space design and technology integration in higher education. All spaces designed should be informed by the following body of research surrounding the scholarship of teaching and learning. More information on how active learning and student engagement strategies are influenced by space design visit the following link: <https://cetl.gsu.edu/programs-grants-awards/active-learning-program/active-learning-research/>

Additionally, further research is identified as being appropriate for holistic classroom design. The following cases have been identified as being in support of the design of classrooms in the effective delivery of student engagement strategies in higher education.

1. Summary of Key Papers of Efficacy of Active Learning (2012)
 - a. <https://ctl.yale.edu/teaching/stem-education-and-evaluation>
2. Educause Active Learning Landing Page
 - a. <https://library.educase.edu/topics/teaching-and-learning/active-learning>

3. Making the Case for Space: Three Years of Empirical Research on Learning Environments (2010)
 - a. <https://er.educause.edu/articles/2010/9/making-the-case-for-space-three-years-of-empirical-research-on-learning-environments>
4. Active learning increases student performance in science, engineering, and mathematics
 - a. <http://www.pnas.org/content/111/23/8410.long#corresp-1>
5. Effects of active learning classrooms on student learning: a two-year empirical investigation on student perceptions and academic performance
 - a. <https://www.tandfonline.com/doi/abs/10.1080/07294360.2016.1196475?journalCode=cher20>
6. A Guide to Teaching in the Active Learning Classroom
 - a. <https://sty.presswarehouse.com/books/BookDetail.aspx?productID=441414>
7. Minimum Classroom Size and Number of Students Per Classroom (2000/2009)
 - a. <https://tinyurl.com/yar4oocu>

Frameworks

Teaching and learning frameworks are research-informed models for instructional design that assist in aligning curriculum into motivating learning strategy. IIT adheres to the knowledge that learning environments are in themselves a powerful teaching tool to be employed by instructors to help support this strategy. Georgia State classrooms fall into the overall IIT course design framework and are important tools for curriculum delivery. Due to this, all information in this document is viewed with that lens as the core competency for defining success in a classroom technology implementation.

Feedback Mechanisms

IIT employs a variety of feedback mechanisms in understanding the University environment in which it operates. These feedback tools take both qualitative and quantitative approach to gathering information from the community. Feedback is compiled on a semester basis and used to influence the technology purchase decisions for coming fiscal years.

1. Once every two years IIT sends out a classroom satisfaction survey to all faculty members at GSU. This survey includes opinions and perceptions of GSU general inventory classrooms and their integrated technology. The survey focuses heavily on the types of learning activities that faculty members both currently and desire to use.
 - a. Current takeaways from the most recent survey of faculty (Spring 2018) include:
 - i. ~96% of respondents indicate some level of comfort with classroom technology.

- ii. ~74% of respondents indicate they strongly agree that the layout of classrooms is important to their teaching.
 - iii. Only ~25% of respondents indicate the existing condition of classrooms enhances their teaching.
 - iv. ~78% of respondents always use a projector during class.
 - v. Other technologies such as white boards, moveable furniture, and the document camera have over 50% response in positive frequency usage.
 - vi. Projectors, whiteboards, moveable furniture, document camera, student power outlets, and student BYOD rank amongst the highest preferred usage from respondents.
 - vii. About half of respondents indicate they bring a device to the classroom and a quarter usually require an adapter.
 - viii. Group discussion and case studies represent the most frequent non-lecture activities utilized by respondents.
2. To capture broader and more qualitative feedback, IIT also calls to session a faculty classroom focus group that meets on a semi-annual basis. This group of faculty are selected from participants in active learning classrooms as well as from interested participants in other IIT initiatives (such as adaptive learning and mixed learning modalities).
 3. IIT also utilizes the Educause Learning Space Rating System to evaluate the overall implementation of various elements of each classroom. Scores for each learning spaces are kept on record and updated once a major renovation of space or technology has occurred.

<https://www.educause.edu/eli/initiatives/learning-space-rating-system>

Compliance and Reference

GSU IIT adheres to industry standards as it relates to infrastructure guidelines, acoustic coverage, visual sightlines, image color and contrast ratio.

Industry Standards

1. INFOCOMM, AV/IT Infrastructure Guidelines for Higher Education
2. ANSI/INFOCOMM 1M-2009, Audio Coverage Uniformity in Enclosed Listening Areas
3. ANSI/INFOCOMM 2M-2010 Standard Guide for Audiovisual Systems Design and Coordination Process (Project Management Process)
4. ANSI/INFOCOMM 3M-2011 Projected Image System Contrast Ratio
5. ANSI/INFOCOMM 4: 2012 Audio Visual Systems Energy Management
6. ANSI/INFOCOMM V202.01:2016, Display Image Size for 2D Content in Audio Visual Systems
7. AV Design Reference Manual, from INFOCOMM International
8. Audiovisual System Design and Coordination Components, from INFOCOMM International
9. CEA/CEDIA/INFOCOMM J-STD-710 Audio Video and Control Architectural Drawing Symbols Standard

10. ELECTRONIC SYMBOL FILES — J-STD-710 Audio, Video, and Control
Architectural Drawing Symbols Standard

11. Avixa 10 Standards of Excellence

<https://www.avixa.org/standards>

Acoustical Guidelines

1. ANSI/ASA S12.60; Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools

http://www.sounddivide.com/uploads/content/file/asa_acoustic_requirements_for_schools-50.pdf

Physical AV Requirements

Instructor Workstation

Audio visual equipment in general scheduled classrooms is generally mounted inside the workstation desk located within the classroom. This workstation typically includes the Crestron control, switching, and other audio/visual components necessary for room operation. The only exception to this is if a plenum-rated ceiling box is necessary for equipment near a projector.

General Size and finish

The instructor workstation utilized by IIT is a Computer Comforts brand desk IT-723032-EF-L (left rack) or IT-723032-EF-R (right rack) and is finished to match the overall aesthetics of the room. In cases where an instructor workstation or approved lectern cannot be installed, IIT will need to be consulted to find appropriate solution for housing and maintaining any gear within a classroom or other learning environment.

Lectern Option

In the event a full-size instructor desk will not fit, or if a specific request is made, a lectern can be used to house a GSU classroom AV system. The lectern approved for use is a Middle Atlantic L5 series lectern at 23" wide and a turret top. GSU must be consulted for finish options in all cases when anything other than our standard Computer Comforts instructor desk is used.

Key Standard

All locks for instructor desks, racks, lecterns, or any other applicable AV lock location will be keyed for 100T keys.

Rack Requirements

Audio Visual equipment located within the instructor workstation is typically mounted into the integrated 19-inch rack. Other racks provided not in the IWS should be of similar size and provide a minimum clearance to the front, rear and one side of 36 inches, unless wall mounted. All equipment, where possible, should have additional rack ears for mounting and easy cable management. Rack design must allow for a maximum 75% fill to accommodate scalability and the possibility of gear change in the future. All racks must have a suitable number of 120VAC mounted power distribution units with NO switch. All power

distribution units must be specified to hold no more than 80% of the power loaded specified on the circuit. If racks are to be installed in cabinetry rear access with an approved locking mechanism must be provided. Where rear access cannot be accommodated, side access must allow for sliding rack to be easily mounted for servicing. Width and depth must be clear of any obstructions for any integrated cable service loops.

Ventilation

All audio/visual gear must be sufficiently ventilated through air cooling to prevent damage to gear and electronics failure. All calculations for required air flow for a design must be carefully considered and consulted with IIT before design completion. Recommended ventilation is a minimum of an air inlet grill in the front and rear doors any furniture with integrated rack equipment. Additionally, a fan mounted on the top of the cabinet is preferred when possible. All fans mounted within classrooms have the possibility of disrupting instruction if they are too loud. All fans should not produce noise louder than 30 dB SPL (A) at 1 meter from the AV equipment so as not to interfere with instruction or recording.

Location

The instructor workstation should be in a suitable location within the room as not to block the instructor from viewing students or blocking content being displayed on TV or Projector. Instructor workstation should be placed in such a way as to allow easy access to power and data either from a floor core or wall chase into the integrated cable management.



Display Requirements

GSU learning environments supported by IIT typically have one projection surface or display in the room. This may change based on consultation with the end user, specific learning goals of the room, or difficult sight lines within the room. All monitors and projection screens must have a 16:9 aspect ratio. Monitors must be capable of displaying a UHD 3840x2160 resolution at 60 Hz. Projectors must be able to accept a UHD signal and output at a minimum 1920x1080 resolution. Projectors will be capable of outputting a minimum of 8000 lumen. Display devices must be capable of receiving HDMI 2.1 standard or newer. Displays and projectors should have RS232 control port installed and enabled, 3.5mm or DB-9 connectors are acceptable. CEC or IR control of a display shall never be used.

Projector Mounts

GSU uses several different products for the mounting of projectors. Products chosen will depend on installation requirements.

Ceiling Interface:

- Plenum Ceiling -FSR or Middle Atlantic plenum box with shelving and built-in fan. FSR CB-22S is a good example of this. AV Integrator will coordinate with GSU Renovations and/or IIT staff to provide a 120v circuit to each box installed. This option is REQUIRED when AV equipment must be near the projector. ie: scaler, amp, receiver.
- Non-Plenum Ceiling – Option 1: Chief CMA440 style plate anchored to structure. Weight limit of CMA440 should be observed.
- Non-Plenum Ceiling – Option 2: Chief CMA330 style deck plate secured with (minimum) 2" concrete anchors into deck. Plate can be mounted to a uni-strut structure if said structure has been inspected and approved by GSU Renovations or contractor.
- Plenum boxes shall be installed into 2x2 ceiling grid no more than one ceiling tile space away from the projector. Installation in an adjacent tile is preferred. Plenum boxes must be securely anchored to the deck at a minimum of two points, using aircraft cable or wire of similar standard.
- Manufacturer's directions and limitations will be strictly adhered to by the integrator. All safety wires and safety accessories will be installed per manufacturer's directions.

Projector Mount/Interface Plate:

- GSU uses Chief RPMAU Universal style projector mounts. Similar Peerless adjustable mounts are also acceptable.
- GSU uses Chief RPMAU style projector interface plates. In certain cases, such as large or heavy projectors, a model-specific interface plate may be used.

- Manufacturer's directions and limitations will be strictly adhered to by the integrator. All safety wires and safety accessories will be installed per manufacturer's directions.

Projection Surfaces

Projection surfaces should not block white boards or other writing surfaces. GSU uses DaLite screens exclusively. Draper or other screens shall never be used. Commonly used screen surfaces are: Matte White, High Contrast Matte White, HD Progressive 1.1 Contrast, and Parallax. Gain and screen material should be specified on a room-by-room basis depending on ambient light within the room and projector lumen count.

Projection screen model is flexible and dependent on customer requirements and the room. Some commonly used screen models are: Tensioned Advantage Electrol, Tensioned Contour Electrol, Tensioned Cosmopolitan Electrol, Model C with CSR, Easy Install with CSR. GSU has standardized on the 16:9 aspect ratio. 16:10 screens shall never be specified or installed.

Display Mounts

GSU IIT uses different display mounts for specific situations and to adhere to installation requirements. Display mounts are to be installed to manufacturers specifications. Screw-in style sheetrock anchors shall never be used. Zip-toggle style anchors are the only approved option when attaching directly to sheetrock. Any display over 65" will require wooden backing adhered to the metal studs. IIT and GSU Renovations must be consulted when backing is needed. GSU uses Chief Fusion Series Tilt Micro Adjustable mounts in all wall mounting situations unless customer requirements differ. In these cases, a different mount will need to be specified by IIT.

Design Standards

Global Standards

Below is a list of standards for Audio Visual system design that are to be implemented across all rooms regardless of size, style, or specific application. Georgia State University is currently a mix of both Crestron and Extron systems. As of January 2018, all new systems will be designed using Crestron control systems and processors. Other manufacturers will be selectively allowed for non-reporting components (such as transmitters and switching devices) upon approval from IIT.

Control Standards

GSU standard classrooms are controlled by Crestron brand interfaces, follow IIT standard workflows, and use standardized icons and backgrounds. A package for all images and menu schemas is available from IIT upon request. GSU performs most

programming and GUI creation in-house. Logic and programming for control devices and touch panels may be performed by the Audio/Visual Integrator when pre-approved by IIT but must match existing IIT touch panels and control schemas. 2:04 PM IIT requires the use of full screen touch panels (TSW-770 or similar) within all classroom spaces.

Touch panels are to be located on the instructor workstation or on the wall (switch height) within five feet of the instructor workstation. If the Crestron touch panel is placed on the instructor workstation, a through-mounted swivel kit is required. The location of the swivel kit and accompanying touch panel must not interfere with the usage of the instructor computer, document camera, or other instructional devices on the desk. It must also be easily reachable by instructors in the seated position. When using the specified Computer Comforts instructor workstation, the cutouts for all mounting options and cable cubbies will be pre-cut.

All control panels will be programmed to connect to the IIT Crestron Roomview Management server and must report as specified in the Roomview Management section of this standards document.

AV Switching

Georgia State University utilizes Crestron switching equipment for University classroom spaces. These devices typically take the form of Crestron DMPS or modular frames for classroom applications. Other switching components may be used in certain situations as the design requires. All devices must conform to High Definition digital signal processing via HDMI. All switchers must be capable of at least:

1. HDCP compliance with full key management on all inputs and outputs
2. EDID Management
3. Scaling/Frame rate conversion
4. HDMI Audio embedding and de-embedding
5. 3840x2160 (UHD) resolution at 60 hertz
6. Color space management

Other solutions that deviate from this must be approved by GSU IIT before the commencement of any work or the approval of design documents.

Audio

GSU has standardized on Extron 220T 70v 2'x2' drop-in ceiling tile replacement speakers for all installations where applicable. Extron 70V amplifiers should be used. All classroom audio systems are summed to mono at the amplifier (exceptions in music rooms). Ceiling tile cut-in circular speakers shall not be used without approval from IIT except in cases where there is no ceiling grid available.

With regards to hybrid or VTC enabled classrooms; a Biamp DSP will be used when analog and either Dante or other proprietary audio formats are used concurrently or when the number of audio signals in a system requires it.

Source Equipment

All source equipment (including instructor workstation computer, student workstation computers, or other devices) must be coordinated with GSU IIT prior to design completion. These devices exist in a rotating standard that update with hardware manufacturer specifications. Special needs around number of outputs and dimensions must be considered for coordination with any AV system or furniture design. See GSU Learning Environments Computer Standards Document (forthcoming) [@Zachary Toler Godwin](#)

Video Conferencing and Lecture Capture

Georgia State University utilizes a combination of Cisco hardware equipment (Cisco Room Kit+ or similar) and Vaddio soft codec systems (AV Bridge Matrix Pro, Easy USB Mixer Amp, EasyIP solutions, and OneLink Bridge HDBT) in classroom environments. The choice of which technology to implement should be consulted directly with GSU IIT based on instructional need and cost. The total technical requirement for the room, the overall shape and design of the room, and instructional goals of the project all play factors into the solution recommended. In either case, high-quality omni-directional microphones mounted from the ceiling are preferred. The mount locations must be made with the location of HVAC inlet/return in mind. In cases where ceiling microphones are not suitable, desk microphones with shock-resistant mounts may also be used.

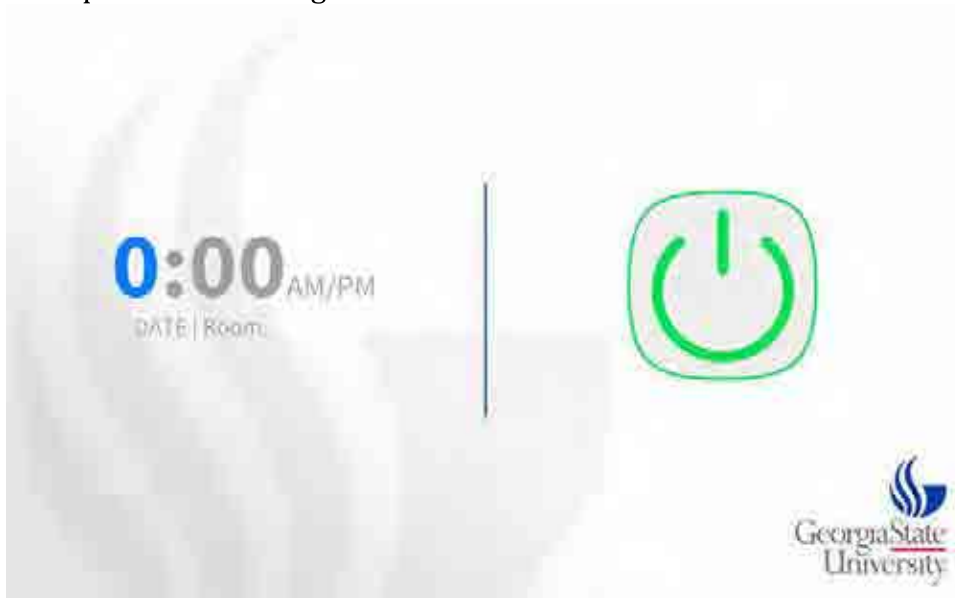
Special consideration for lighting in VTC enabled rooms is required. Participants in a VTC call should be well lit to ensure a high-quality picture on camera without straining the white balance or aperture limitations of the camera. Effort should be made to remove or restrict light bleed into the room from windows, glass doors, or other sources. Blinds or blackout curtains may be used with consultation from IIT.

System Programming

GSU IIT provides programming architecture and configuration services, however while not preferred, there are situations where outside vendors are required to provide these services in lieu of in-house options. In this situation IIT requires contractors to adhere to the following architecture and design standards and to conform with all networking, security, and other IIT policies.

IIT utilizes Crestron programming and requires all systems designed at GSU to conform to Crestron designs. All touch panels must resemble the format displayed below. A full list of programming elements is available upon request from IIT.

Example TSW Title Page:



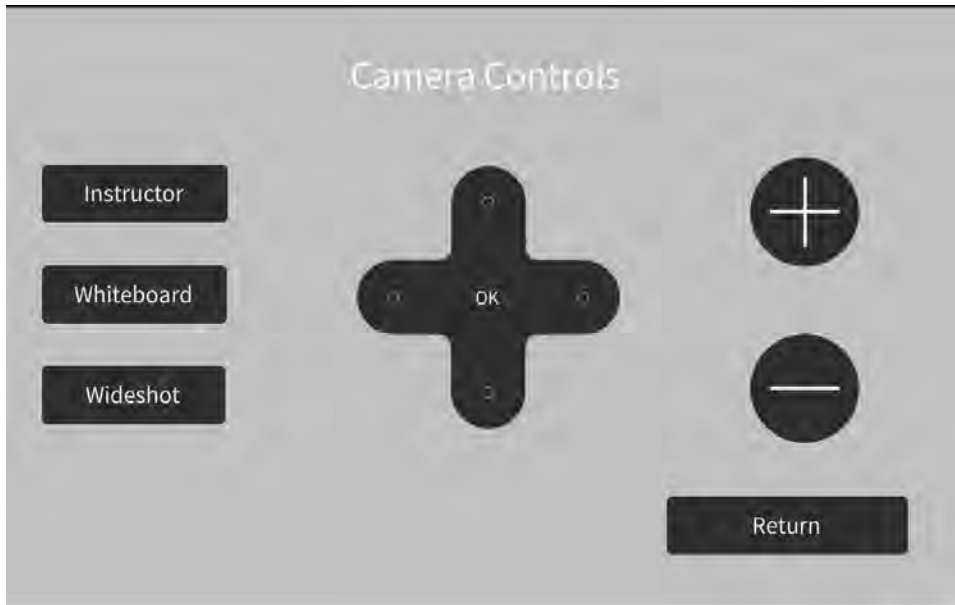
Example Push Selection:



Example Drag and Drop Selection:



Example Camera Control Sub Page:



Please note that a system start-up and cool-down splash page must be displayed on all systems regardless of using lamp or laser projectors. This is to ensure that the system has ample time to send and receive signals from all devices before performing new actions from the user. A progress bar must be used with a percentage count to completion. The length of time for the startup timer will be 20 seconds or the amount of time the slowest component of a given system needs to be ready to use. All system user interfaces must be approved by IIT before implementation and adhere to the provided template.

The Crestron program must be created in SIMPL Windows. All GUI files must be created in VT Pro.

Administrative Rights

GSU IIT must be given administrative rights to all systems designed on GSU campus. Any hardware deployed within GSU classrooms must also be configured as to have administrator rights transferred to IIT once the job is complete. All programs and GUI interface and its elements written on behalf of GSU must have their uncompiled source code and associated images delivered to GSU IIT after completion of any work. This policy is also backed up by the State of Georgia DOAS AV state contract. Contact your GSU AV resource before password protecting any devices.

Roomview Management

All systems shall be capable of connecting to Crestron Roomview server version 10 or newer. The following parameters must be reporting on all room systems:

Client Assets

1. All Crestron hardware devices
2. Video input sources
3. Displays
4. All controlled devices

Asset Parameters

5. Power state for applicable components in the AV system: projector(s), display(s), Vaddio Mixer bases (AVBMP / Easy IP)
6. Display source selection of AV switcher

Control Methods

7. Display on/off control
8. System power on/off
9. Source Selection
10. Picture / Source Mute

Room-Specific Standards

Some rooms designed within GSU may require additional consideration for their environmental constraints or opportunities. Most learning environments at GSU conform to standard sizing and furniture and seat 24-60 students. In cases where the number of student participants is significantly greater or lower, technology and furniture considerations should be looked at closely.

Auditorium Considerations

All GSU auditoriums are equipped with specific technology that matches the needs of the instruction most common within these spaces. In general, all GSU auditoriums include in addition to standard Crestron configuration:

1. Shure wireless transmitter and receiver system (G50 470-506 Mhz)
2. Minimum 8,000 Lumen Epson Projector
3. Elmo PX10E or better document camera (1920x1080)
4. Maximize whiteboards around the room

Seminar Considerations

All GSU seminar rooms are designed for usage for sub 20 persons and are focused on group discussion. These rooms do not have the same standards for instructor workstation or integrated devices. Seminar rooms (designation to be determined by GSU IIT in coordination with GSU Facilities) will adhere to the following standards and included technology:

1. Form factor instructor workstation
2. Wired device connection
3. Wireless collaboration device
4. TV Display only (No Projector)

Computer Classroom Considerations

All GSU computer classrooms are defined as regular classrooms with one-to-one integrated student devices (PC's). These rooms are typically scheduled for classes requiring computing resources. Computer classrooms should have similar requirements to normal classrooms apart from the use of wireless collaboration systems.

Network and Security Infrastructure

Architecture Overview

IIT requires all vendors adhere to the following standards when putting any device on the GSU network or using twisted pair cables for video transport. Please note there are a variety of similar interfaces that are appropriate for various points within the installation process. GSU IIT takes great attention to cables that are better suited for interaction with endpoint users versus those that are better suited for infrastructure and long runs. Any deviation from this list must be approved by GSU IIT prior to the installation.

Procurement Update

[@Patrick P. Dortch](#) to add information about IT devices on the network with current policy

Cabling

Please refer to the table below for specific standards and cable specifications for installation jobs at GSU.

Type	Description	Manufacturer
HDMI-Installation	In-Rack, thru wall, in ceiling	Comprehensive Pro-Grip, Extron
HDMI- Customer Device Connection	Laptop connection, guest connection	Extron Ultra-Flex
HDMI Fiber Hybrid	Long-Distance Fiber/HDMI Cabling	Kramer or FSR
Display Port-Customer Device Connection	Absolutely no DP/HDMI adapters allowed	Comprehensive / C2G
Audio - 8 Ohm Speaker	14 ga or larger stranded copper	Belden or similar
Audio - Line Level Mono	Balanced or Un-Balanced	Belden 9451P - Black
Audio - Line Level Stereo	Balanced or Un-Balanced	Belden 9451D - Red/Black or Red/Blue
Audio 70V Speaker	70V Audio system - Plenum	Belden 6300UE/6200UE
USB 3.0		Various
Data - RS232	RS232 Control Cable	Belden 9451P
Data - AV HDBT	Shielded CAT6a	Belden 1352A
Shielded CAT6a Connectors	Connectors for Belden 1352A	Sentinel 111S08080090C34
Standard RJ-45	EZ Style shall NEVER be used	Sentinel 101-080800-24 or similar

Labeling

Each installation cable shall be labelled on each end no closer than 2" from the connector. Labels shall list source and destination. In the event cable numbers are used, a cable cross-reference sheet will be provided to GSU IIT. Labels shall be self-laminating type (Panduit S100X150VAC or similar). Tape, electrician's wire marker numbers (3M 797A621 or similar), or non-wraparound labels shall never be used.

Specifications

For GSU networking cabling standards please refer to the IIT network standards and guidelines: <https://facilities.gsu.edu/files/2019/08/GSU-Design-Standards-January-2018.pdf> A copy of these guidelines can be provided upon request. Be advised, GSU network cabling standards does not apply to Shielded CAT6/7 carrying Crestron DM, Extron DTP, or other similar signals. Please refer to Appendix D (this document) for those standards.

Data Network Requirements

All systems with AV connectivity to the data network will need to be identified to correctly set up the device within the GSU networking conventions.

GSU IIT utilizes DHCP Reservation with a lease time of 24 hours in the Atlanta campus and 8 hours at the Perimeter Campuses.

All devices follow a standard hostname schema in the following form:

AV-BLDG####-IPID

AV = Always the acronym "AV"

BLDG#### - Indicated the building name and room number (a list of approved abbreviations will be provided from GSU IIT)

IPID = Referential number for endpoints inside a Crestron system (always hexadecimal). A list of referential numbers can be made available upon request.

- a. Processors are **always 01**
- b. Matrix frame or other external AV switcher is **always 02**
- c. XPanel for Roomview is **always 03**
- d. Touch Panel is **always 04 and 05 if needed**
- e. Fusion Room is **always 06**
- f. Network Connected Displays or Network (not DM) Connected Transmitters or Receivers are **always 10-19**
- g. Vaddio (or other) VTC Bridge / VTC Mixer is **always 20**
- h. Cameras are **always 21-24 as needed**
- i. Luxul in-desk switch is **always 30**
- j. Shure (or other) wireless receiver is **always 31**
- k. Dante Mics are **always 32-39**

- l. BiAmp or Other DSP is **always 40-43**
- m. Crestron NVX endpoints are **always 50-69**

Example Hostnames

AV-LH200-01 (AV - <Langdale Hall><Room Number> - <Processor ID>)

AV-LH200-04 (AV - <Langdale Hall><Room Number> - <Touch Panel ID>)

Air Media devices: **AM-BLDG####-IPID**

Soltice Pod: **SP-BLDG####-IPID**

Example Hostnames

AM-LH200-01 (AM - <Langdale Hall><Room Number> - <AirMedia ID>)

SP-LH200-01 (SP - <Langdale Hall><Room Number> - <Pod ID>)

All Crestron and network AV devices (including video conferencing codecs) must be configured on a separate VLAN to prevent these devices from becoming inoperable. The VLAN for these devices must be coordinated with GSU IIT and IIT before installation begins.

At minimum, 3 network ports must be available in each classroom

1. Instructor Computer
2. Telephone
3. AV VLAN – Control

An additional port(s) will be needed when a wireless content sharing device(s) is included with the system.

4. AV VLAN – Collaboration

On the incredibly rare occasion a hardware codec is included in a system, an additional standard network port will be needed.

5. Cisco Codec

In almost every case, an in-room switch ([Netgear GS108LP](#) for small rooms) and ([Luxul AMS-1816P](#) for large) will be required. Standard practice is to uplink this switch to the AV VLAN port and connect all in-room AV equipment to the in-room switch. DHCP and DNS resolution will be provided by GSU infrastructure. Contact your GSU AV resource for switch configuration and best practice documentation.

Installation Process

General Guidelines

The Audio/Visual integrator will install all equipment purchased in scope of an accepted proposal to the specifications outlined within this document. All work is to be completed to a high standard with a fully functioning system to be turned over to IIT at the completion of the project.

1. In alignment with AV industry best practices, all mounting hardware will be a minimum Grade 5 hardware. All load calculations will use a minimum 5x safety factor so that each fastener can carry the load of the object by itself plus the redundant anchors.
2. GSU IIT will provide all network ports in the form of POE.
3. Audio will be free of any feedback or other noise. Speaker locations are to be based on reasonable determination of best sound coverage from the front of the room.
4. Projection image is to be free of any hum bars, shimmer, flicker, ghosting, or other undesired anomaly up to the native resolution of the device.
5. All plates, controls, brackets, wall equipment, and cabinets should all be mounted flush, square, and level. Mounting hardware used to fix a specific item should also all be Grade 5 or better and matching for that specific item.
6. The audio-visual integrator will make clean cutouts (no more than .25 inch outside the diameter of the object) for any projector poles or other mounts that pass through a drop ceiling.
7. All cable management will be done to a professional standard, tidy, and be free of any loose ties or non-flush cut zip anchors. The integrator will provide more than adequate strain relief with special attention given to any device that is used by an end user. See example below:



- a.
8. The integrator will also provide a cable service loop in cases where a device is designed to be mobile. See example below:



- a.
9. In consultation with IIT, provide enough adequate power to the projector, lectern and other projection screen. All circuits must be linked to the common earth. All electrical works must be provided by a licensed electrician and completed to NFPA 72 and other US standards.
 - a. IIT recommends a quad outlet and data box behind TV displays. See example below:



- b. IIT recommends standard outlet for projectors either inside a plenum box or mounted on the drop ceiling. See example below:



Commissioning

The audio-visual integrator must provide the University with a commissioning schedule/program before commencement of the project. The schedule will be approved by IIT before full commissioning of the system. All equipment necessary by the integrator to commission and test the system will be identified prior to the contract and will be outlined in the program schedule. Any coordination with GSU IIT will be marked in the program schedule as a part of the commissioning plan.

Inspection and Testing

The University may undertake inspection and QA assessment of the works performed throughout the installation process. All inspection will be arranged prior and in consultation with the Audio-Video integrator and will not interfere with works being conducted onsite.

After substantial completion of work the audio-video integrator is required to perform a full system test of all contracted equipment. All operating function and connectivity must be demonstrated in the presence of GSU IIT staff before system hand off. In addition to integrator testing, IIT will also conduct separate testing of the system that will document any failure to the audio-visual integrator that is in

scope of the original contract. It will be expected that the integrator will address any in scope issues within one week of receipt.

Operator Training

In cases where a full integration is contracted (engineering, design, project management, programming, and installation) the audio-visual integrator will also be expected to contact GSU IIT about the possibility of at least one structured training session for the end users. The training session is to take place at specified time within reason after final hand over of the project. Cost and hours of this training session are to be negotiated with IIT prior to contract acceptance.

Project Documentation

GSU IIT expects the audio-visual integrator to document all projects and compile records of installs to be handed over after project completion. The project notes should include:

1. An easy reference to the project contract details for all supplied equipment and system components. This list should also include a list of all professional services detailed out by line item and rate for each.
2. All manufacturer manuals, software, and warranty for equipment specified in the proposal.
3. A copy of 'as-built' system block line diagrams. This can be a mark-up of the original design with any changes that were made or other deviations from the original design.
4. A complete and unprotected and un-compiled copy of the Crestron program is to be supplied via either a downloadable link or USB drive. Note that all equipment control modules used in the program need to be provided along with the code in a separate folder. All touch panel design files should also be included in a separate folder.
5. A complete list of all equipment supplied along with which room it was installed in. This list should include:
 - a. Make
 - b. model
 - c. description
 - d. serial number
 - e. MAC address
 - f. IP address
 - g. Host name
 - h. Room location

Warranty, Service, and Support

All equipment specified and installed under the audio-visual proposal must be guaranteed free of defects in hardware and software that was the result of poor work performed or programming for at least 12 months from the date of sign off.

Required Hardware

Overview

The following hardware list is to be followed as closely as possible in all installation cases. Special exception to the device and manufacture requirements detailed below is only to be given directly by GSU IIT under special circumstances or budget constraints. A document that is signed by both GSU IIT and the end user of the system will need to be created stating that the hardware chosen for the job falls outside the general recommendations of IIT and may not perform to the standards and quality expected of other AV systems within the University.

Display Options

Type	Model	Manufacturer	Description
Laser Projector	EB-PU1008W	Epson	8000 Minimum Lumen
Lens	ELPLM08 or M15	Epson	Middle Throw
Laser Projector	VPL-PHZ60	Sony	6000 Lumen. Perimeter College only.
Lamp Projector (non-short throw)	N/A	N/A	Do not use
Short Throw Projector	Varies	Epson or Sony	Consult IIT
Display (TV)	FW55BZ40H or larger	Sony	No Sharp

AV Control, Distribution, and Switching

Type	Model	Manufacturer	Description
Processor	3 and 4 Series Processor	Crestron	RMC4 or DMPS3 Series
Switcher	DM-MD or NVX	Crestron	8x8 or 16x16
Touch Panel	TSW Series	Crestron	7 or 10-inch panel (no 5 inch)
Button Panel	MP Series	Crestron	MP-B10-B-T or similar for specific use – consult IIT
Distribution Amplifier	DTP HD DA4K	Extron	This device is used instead of DAs

Distribution Amplifier	DA HD 4k 2	Extron	No HDMI Distribution Amplifiers EVER
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Audio

Type	Model	Manufacturer	Description
Amplifier	XPA or MPA Series	Extron	
DSP	Tesira FORTE DAN CI	Biamp	Audio Mixing and manipulation

Microphone

Type	Model	Manufacturer	Description
Gooseneck	MX Series	Shure	Mounted on instructor workstation
Lapel	ULXD G50 Series	Shure	Cardioid pickup patterns
Handheld	ULXD G50 Series	Shure	Cardioid pickup patterns
Receiver	ULXD G50 Series	Shure	Receiver type to be determined by IIT prior to installation

Speakers

Type	Model	Manufacturer	Description
Ceiling	FF 220T	Extron	70 Volt. For use in GSU classrooms
Front Mounted	VX Series	Tannoy	70 Volt or 8 Ohm.

Document Camera

Type	Model	Manufacturer	Description
HDMI	PX10E	Elmo	Mandatory in all GSU classrooms

Instructor Content Devices

Type	Model	Manufacturer	Description
PC	G6 or newer	HP	HP All-in-One used in GSU Classrooms. Instructor workstations

			should include touch screen.
Apple	Do Not Use	Do Not Use	We do not recommend Apple devices in GSU classrooms and all integrated Apple devices must be consulted with IIT.
Whiteboard Capture	Canvas	Huddly	@Patrick P. Dortch

Racks

Type	Model	Manufacturer	Description
Varies	Varies	Middle Atlantic	Size, models, and space utilization will be determined based on installation requirements.

Power Conditioner/Distribution

Type	Model	Manufacturer	Description
Conditioner	Varies – NO SWITCHES	Furman, Geist, Middle Atlantic	Model and size to be determined based on installation requirements.
Sequencer	Do Not Use	Do Not Use	We do not use power sequencers.
UPS	@Patrick P. Dortch		

Video Conferencing

Type	Model	Manufacturer	Description
Simulcast Classroom	AV Bridge Matrix Pro, EasyIP, OneLink Bridge HDBT, Q-USB systems	Vaddio	Used to add-on video conferencing to a standard classroom

Other	USB Mixer Amp and associated products	Vaddio	For use in GSU spaces with budget constraints
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Video Camera

Type	Model	Manufacturer	Description
USB	L1	Huddly	Large conference room solution
USB	Panacast3	Jabra Systems	Panorama-based video conferencing
HDMI / Simulcast	Wideshot, Zoomshot, Intellishot, or Roboshot Series	Vaddio	For use with AV Bridge or USB Mixer Amp, Consult IIT
USB	Canvas	Huddly	Whiteboard enhancement

Instructor Furniture Workstations

Type	Model	Manufacturer	Description
Instructor Furniture Workstation	IT-723032-EF-L or IT-723032-EF-R	Computer Comforts	Left or right-side rack to be determined at time of installation. Used in all GSU standard classrooms (Not seminar rooms)
Lectern	L2 or L5 Series	Middle Atlantic	Rack Mounted Lecterns. Not used for classrooms - consult IIT
Space Saver Instructor Furniture Workstation	IT-3030SS	Computer Comforts	Used in GSU Seminar Rooms

Wireless Presentation

Type	Model	Manufacturer	Description
Presenter	Solstice Pod	Mersive	Wireless Presentation for GSU Classrooms
Presenter	Airmedia 2.0	Crestron	Used in non-classroom applications

Whiteboard

Type	Model	Manufacturer	Description
Mounted	Series 800	Claridge	Porcelain board – Must have metal rails and borders
Mounted	Float	Clarus	High end glass mounted board
Mobile	Go! Mobile	Clarus	High end glass mobile board

Localized Network Switch

Type	Model	Manufacturer	Description
Small Rooms	GS108LP or GS108PP	Netgear	8 port, POE+, unmanaged switch. Model determined by POE requirements.
Large Rooms	AMS 1816P	Luxul	18 port, POE+, managed switch. Used in rooms with DANTE enabled products.

Accessibility

Hearing Augmentation

In situations that call for it, the audio-visual integrator must supply and install assistive listening devices. The hardware recommended is listed on the GSU disabilities services website below.

GSU Disability Services:

1. <http://disability.gsu.edu/services/assistive-technology/>

Mount Heights for Visually Interactive Devices

A mount height of 54 inches is allowed if the device installed is approachable from the side. Otherwise a maximum height of 48 inches is necessary.

Digital Signage

All GSU Digital Signage must adhere to the Georgia State University Digital Signage Guidelines found here: <https://commkit.gsu.edu/files/2017/07/2017-GSU-Digital-Signage-Policy.pdf>

Display Location and Installation:

- Schools, departments, units are responsible for the funding of equipment, licenses and installation costs. Department's digital signage requests must include their academic dean's or vice provost's approval for digital signage location and funding.
- Equipment purchases must be coordinated and approved through the University Public Relations and Marketing Communications Digital Strategy Team and the Learning Environments Design Team to maintain consistent branding, quality, technological and installation requirements.
- The Digital Strategy Team and Learning Environments Design Team will construct Panther Mart Carts and assign to the business managers within the specific department, licenses and coordinate installation of hardware and software.
- GSU IIT will maintain server and server software.
- Equipment must be installed by GSU Learning Environments Design Team or designated representative. Additionally, The Digital Strategy Team in conjunction with Georgia State University Design and Construction when applicable, will approve digital signage locations within buildings to comply with fire code, ADA requirements, and historical building and structural standards.
- Equipment that is presently in use can remain in place until updates are required so long as the system is compatible and can incorporate displayed content (see below) and was installed in a manner that complies with all applicable building codes.
- Any new implementation of large scale projects such as LED Videowalls, Projectors, or exterior displays must get its source content from a Visix Player. No other Digital Signage system is authorized on campus in order to maintain a centralized system across all six campuses.

Electronic Door Signs (Paper Whites):

- Schools, departments, units are responsible for the funding of equipment, licenses and installation costs. Department's digital signage requests must include their academic dean's or vice provost's approval for Electronic Door Signs location and funding.
- Approval of the Department / Colleges Dean or VP of that unit confirming the project in writing
- Allowed locations of Electronic Door Signs are:
 - Conference Rooms
 - Meeting Spaces
 - Departmental Seminar Rooms

Equipment Specifications:

All GSU Digital Signage Equipment is required to be 4K Resolution unless the project space is under 49" requiring the display to be a Commercial 1080p Display. All Digital Signage Players must be purchased through The Learning Environments Design Team in order to purchase with negotiated State Contract Pricing through the HP Vendor.

All Digital Signage Displays are standardized to the following equipment in accordance to the following scenarios:

Drywall Locations / New Construction:

- Sony Commercial 4K Displays
- HP EliteDesk Mini PC
 - I7 Processor
 - 128 Solid State Drive
 - 8GB RAM

Exhibit E - Electronic Door Access Installation Guide

About This Guide

This document was developed by Georgia State University Campus Services Information Systems as a guide to assist Designers and Contractors with the installation and wiring of electronic access control systems. This document serves to **supplement official architectural specifications and drawings provided by the University - it does not replace them**. In all places where specific part numbers are provided, **no substitutions will be accepted without express written permission from the GSU Project Manager**.

Questions should be directed to:

Barry Bailey, Assistant Director, Campus Services Information
Systems bbailey19@gsu.edu 404-413-9571

Access and Security Systems at Georgia State University Atlanta Campus

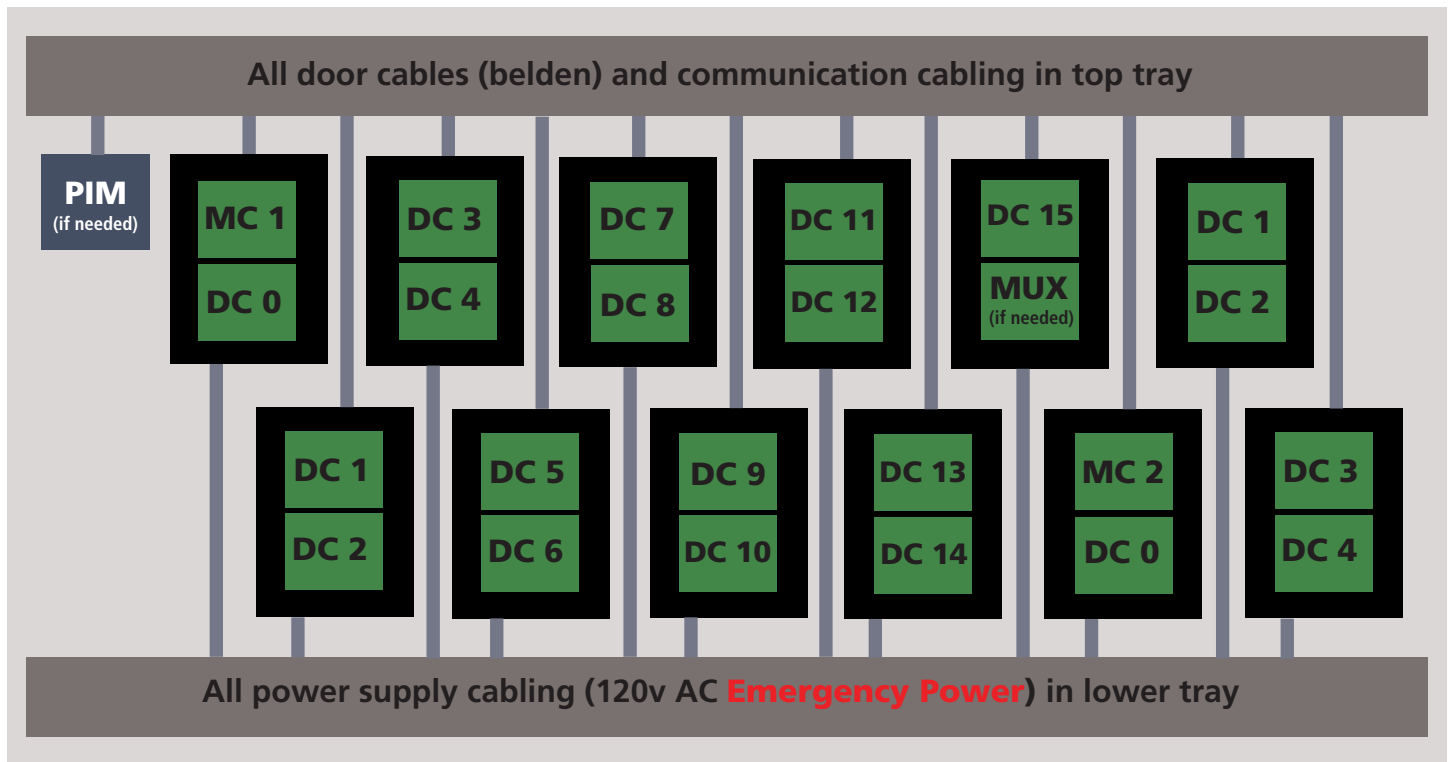
Georgia State University Atlanta Campus uses a Transact security system. As such, some of the access components are proprietary. Where indicated below with 'Blackboard' only these components will function with this system. No 'off-the-shelf' substitutions are acceptable for these devices. Other components listed without a 'Blackboard' designation are not proprietary, but preferred.

Part Specifications / Provided by Contractor

- Blackboard SA3032 Master Controller(s) **(MC)**
- Blackboard SA3000 Door Controller(s) **(DC)**
- Blackboard PS24ENCL Power Supply and Enclosure
- Blackboard DR4100 Card Swipe (Magnetic and Contactless) **(CR)**
- Blackboard Card Swipe Mounting Plates and Weather Visors
- Blackboard SM88 Security Multiplexer(s) (where needed) **(MUX)**
- Schlage AD400 Wireless Lock (where needed)
- Schlage PIM400 Wireless Interface (where needed) **(PIM)**

- Junction Box & Terminal Strip
 - Junction Box Hoffman # A1212CHFL
 - Back Plate Hoffman # A12P12
 - Terminal Block Allen Bradley # 1492-J3
 - Terminal Block End Barrier Allen Bradley # 1492-EBJ-3
 - End Barrier Allen Bradley # 1492-N16
 - Mounting Rail Allen Bradley # 199-DR1
- Recessed Door Position Switches Locknetics 679-05HM
- Door Alarm / Horn Locknetics 1910-1
- Power Supply (for Exit Device Doors) VonDuprin PS914 w/ 900-2RS board
- Electronic Power Transfer Hinge VonDuprin EPT-10
- Exit Device / Crash Bar (where required) VonDuprin 99 EL LX RX
- Plywood backing to mount enclosures (see mounting specs)
- 4x4 (2) straight wire way mounted above and below enclosures (see mounting specs)
- All required conduit (no exposed cabling is permitted)
- Belden Communication cabling (Belden 8723 or Belden 9542 - as specified)

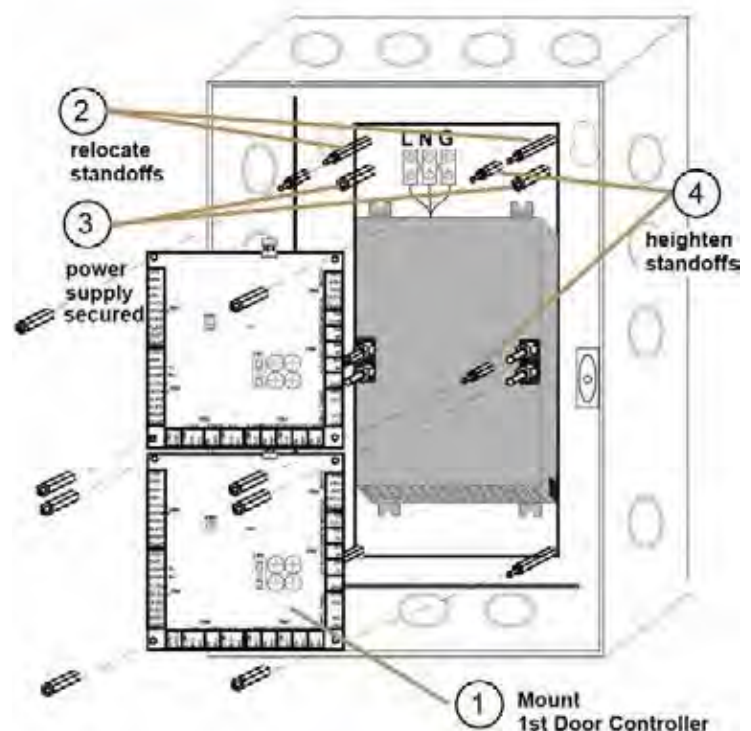
Mounting Specifications



Enclosure 1 will have the first Master Controller (MC1) and the first Door Controller (DC0). These boards can be attached to the Power Supply standoff posts without any modifications. MC1 and DC0 will be connected with the provided ribbon cable (described on the next page).

Boxes containing two DCs or Multiplexors will need to have the standoff post configuration modified as described and pictured below:

1. Secure the first DC onto the lower four standoff posts and secure with four 3/4" standoffs from the hardware kit
2. Remove the 2" posts from the top of the power supply and fasten them to top two screws to accomodate longer DC
3. Fasten two 3/4" standoffs on to the lower screws the 2" posts were removed from to secure PS to enclosure
4. Fasten four 1/2" standoffs onto the top four standoff posts to raise the top DC to allow for wiring
5. Mount the second DC on the top four posts and secure it with four 3/4" standoffs



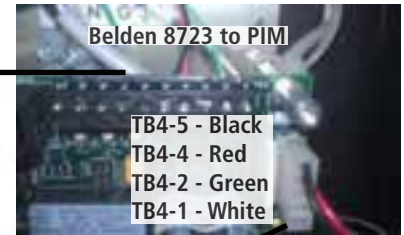
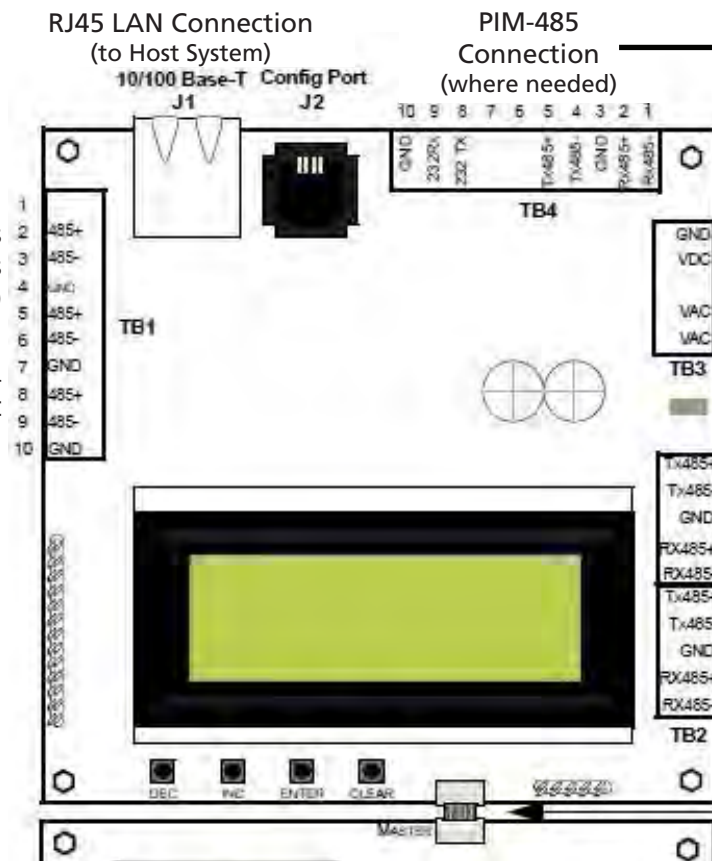
Power Supply Enclosure Dimensions:
13" High x 9" Wide x 4" Deep

Blackboard SA3032 Master Controller (MC) Wiring



Serial Connections
to subsequent DCs
(1 to 15 - if present)

May be daisy chained
or wired in a star
configuration back to MC



Power
Connection



MUX
Connection
(where needed)

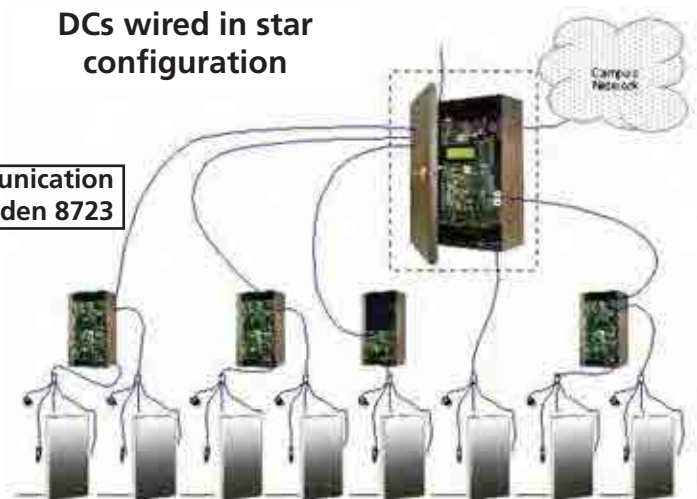
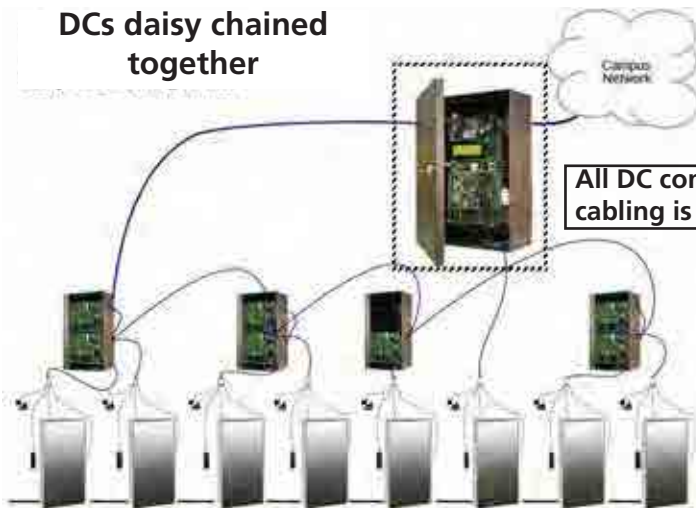
Ribbon cable
connecting
MC to DC 0

Maintain 1/4" separation between AC wiring and all other wiring!

Door Controller (DC) Serial Connection Options

DCs daisy chained
together

DCs wired in star
configuration

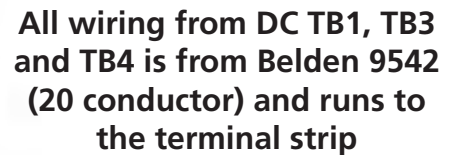


In the daisy chain configuration, DC 1 is connected to MC-TB1-Pins 8,9 & 10 (see above), and then DC2 is daisy chained to DC1, DC3 to DC2 (and so on up to DC 15). No more than 16 DCs can be attached to a single MC.

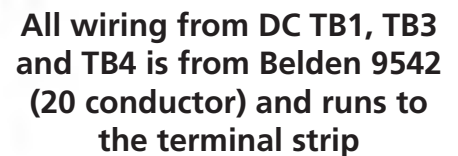
In the star configuration, all DCs are homerun back to the three serial connections found on MC-TB1-Pins 2-4, 5-7, and 8-10. No more than 16 DCs can be attached to a single MC.

Total RS485 wiring for DC communication must not exceed 4000 feet per Master Controller!

NON Exit Device (Crash Bar) Door Wiring

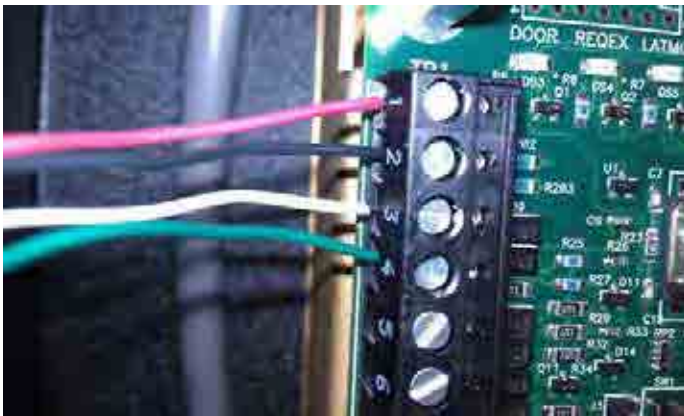


Exit Device (Crash Bar) Door Wiring

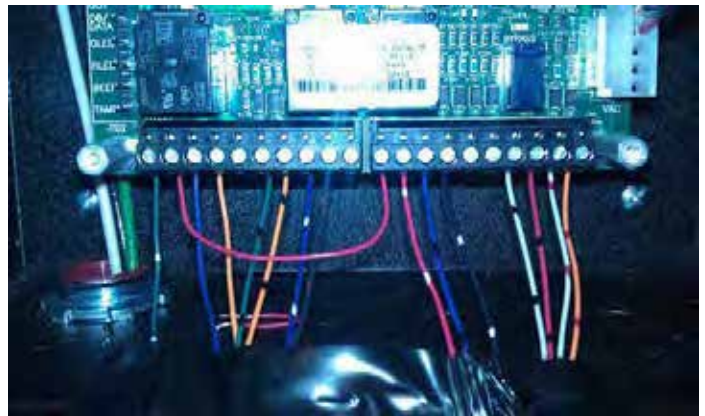


SA3000 Door Controller (DC) Wiring Closeups

TB1 - Card Reader to Terminal Strip
Red/Black/Green White from Belden 9542



TB3/TB4 - Door Connections to Terminal Strip
Remaining conductors from Belden 9542



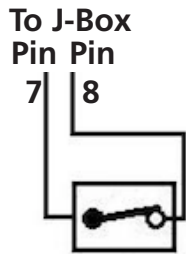
Junction Box (J-Box) Terminal Strip Wiring

TERMINAL BLOCK INPUTS FROM SA3000 DOOR CONTROLLER				TERMINAL BLOCK OUTPUTS		FINAL DESTINATION
PIN	BELDEN 9542	TB PIN	PURPOSE	BELDEN 8723		
TB1 1	NA Red	1	Card Reader (cable runs to card reader)	Red		To CR TB1-1
TB1 2	NA Black	2		Black		To CR TB1-2
TB1 3	NA White	3		White		To CR TB1-3
TB1 4	NA Green	4		Green		To CR TB1-4
TB3 3	NA Blue	5	Door Unlock Control (cable runs to door power supply)	Black		To common on 900-2RS
TB3 4	NA Orange	6		Red		To Input 1 on 900-2RS
TB4 7	White/Black	7	Door Position Switch (to DPS in door frame - see next page)	White		DPS
TB4 8	Red/Black	8		Green		DPS
TB3 6	Green/Black	9	Latch Monitor (to power transfer hinge)	Red	PTH Violet	* If two crash bars, each must be wired independently. One from output 1 and one from output 2 from 900-2RS. In this situation, 900-2RS should be placed in "sequential mode"
TB3 7	Orange/Black	10	Request to Exit (to power transfer hinge - normally open)	Black	PTH White	
TB4 3	Blue/Black	11		White	PTH Red	
TB4 4	Black/White	12		Green	PTH Blue	
TB4 2	Red/White	13	Door Open Alarm (to horn above drop ceiling)	Red		Horn + terminal
TB3 1	Green/White	14	Outside Handicap Button Enable (where required)	Black		Horn - terminal
TB3 8	Blue/White	15		Red		Operator Door Contacts
TB3 9	Black/Red	16	Handicap Request to Exit (where required - sends rex to Dr. Ctrl.)	Black		Operator Door Contacts
TB4 9	White/Red	17		White		Operator Aux Contacts
TB4 10	Orange/Red	18	SPARE	Green		Operator Aux Contacts
	Blue/Red	19				
	Red/Green	20				

Electronic Power Transfer (EPT) Hinge Wiring

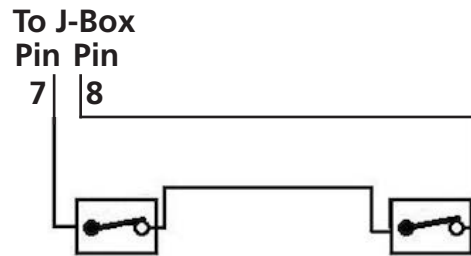
		Transfer Hinge	
Latch Monitor Norm Closed	Violet		To junction box terminals 9 & 10
	White		
Request to Exit Norm Open	Red		To junction box terminals 11 & 12
	Blue		
Solenoid lead to three wires together			12 ga wire to strike bar power supply
Solenoid lead to three wires together			12 ga wire to strike bar power supply

Door Position Switch (DPS) Wiring



Single Door

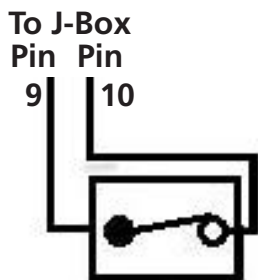
When the door is closed, the circuit is closed. When the door is open, the contact is broken, causing an open circuit. On Locknetics 679-05 DPS, White and Black wires are used, on 7766 and 7764, Yellow and Red wires are used.



Double Doors

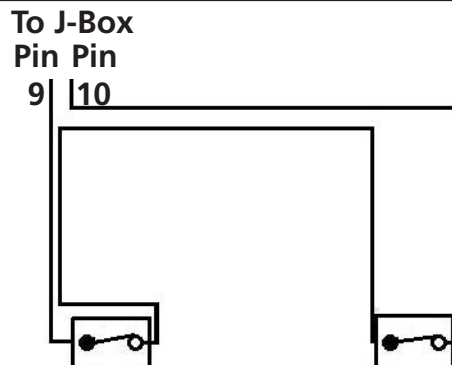
Typically the switches are mounted close enough together in the door frame so that one wire from each switch can be connected together inside the frame and a single pair of wires ran back to the terminal strip.

Latch Monitor Wiring (Exit Device / Crash Bar Doors Only)



Single Door

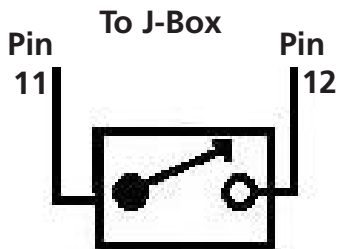
The latch monitor is wired normally closed. When the door is closed, the circuit is closed. When the latch is tampered with or taped open, contact is broken, causing an open circuit.



Double Doors

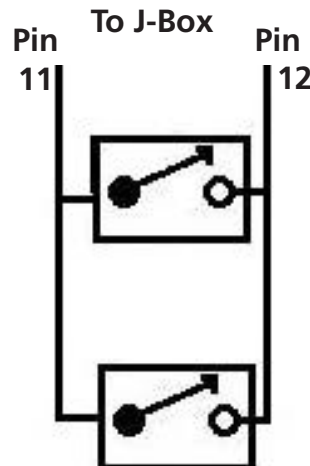
Also wired normally closed. Typically wires from both crash bars are brought back to the terminal block and **connected in series**.

Request to Exit (REX) Wiring



Single Door

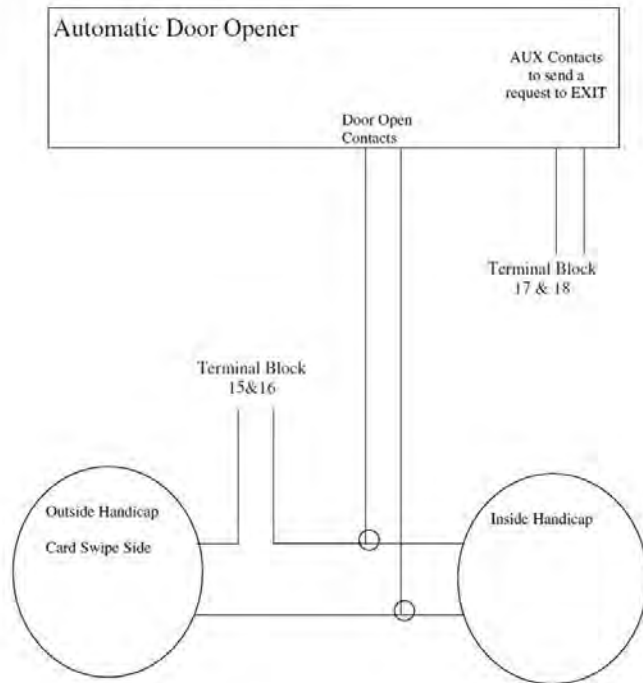
The REX is wired normally open. When the latch is turned or the exit device is depressed, the contact is closed and the circuit is completed.



Double Doors

Also wired normally open. Switches are wired in parallel. Typically wires from both crash bars are brought back to the terminal block and connected in parallel.

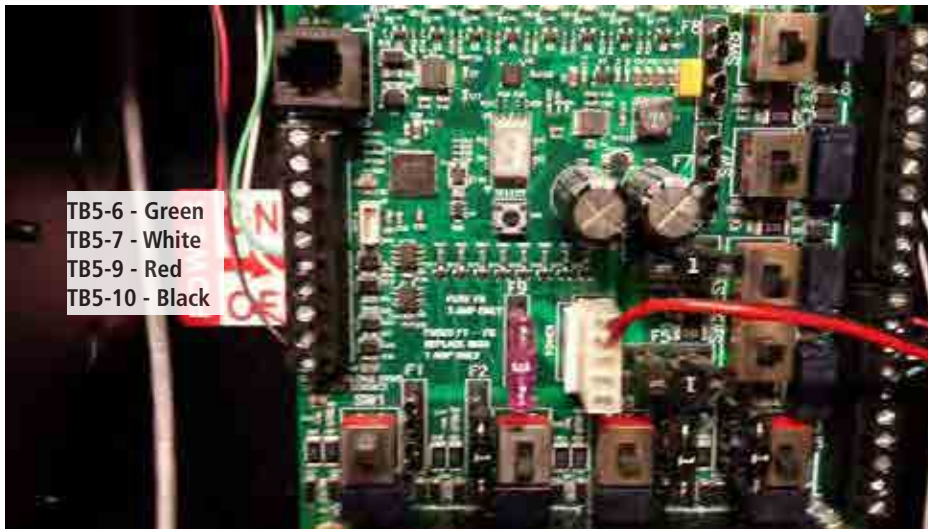
ADA Operator Auxiliary Relay Wiring



The connections to terminal block 15 and 16 require the door to be unlocked by the access control system in order to enable the outside button to open the door. If the door is locked, the outside button is inactive. This ensures that the operator does not attempt to open a locked door.

The connections to terminal block 17 and 18 cause the access control system to unlock the door, and then sends a delayed signal to the operator to open the door. This ensures the door is unlocked before the operator attempts to open it.

Auxiliary Connections - SM88 Security Multiplexer



The SM88 is an I/O logic board that allows for eight inputs (dry contacts) and eight outputs (either dry contacts or voltage drivers, depending on switch setting)

In most cases, we utilize an SM88 to connect Door Position Switches (DPS) and Door Alarms / Horns for monitored openings that are not fully controlled

Each I/O terminal block on the Mux (TB1,TB2,TB3,TB4) contains a pair of input and output channels. The pins on each channel are in the following order: IN A, IN B, COM-, NO+, NC+.

When hooking up a DPS and Horn, the input from the DPS would be wired to IN A and IN B normally closed, and the horn would be wired black to COM- and red to NO+ on the appropriate MUX channel. When powering a horn from the MUX the selection switch must be in the down position to send voltage to the horn.

MUXs are not utilized in all installations

Auxiliary Connections - Panel Interface Module (PIM)



An Allegion / Schlage Panel Interface Module is utilized to allow Schlage AD 400 Wireless Locks to communicate with the Blackboard Master Controller, and in turn, the Blackboard Transact Access Control System.

A PIM can communicate with up to 16 wireless locks, provided they are in range of the PIM, and provided the total number of doors on a single MC (both wired DCs and wireless doors on the PIM) does not exceed 16 doors.

PIMs are not utilized in all installations - they are only utilized when installing wireless locks in a retrofit situation

Campus Services Information Systems
66 Courtland Street
Atlanta, GA 30303
Revised August 2022

Access and Security Systems at Georgia State University Perimeter College Campuses

Georgia State University Perimeter College Campuses use a CBORD security system. As such, some of the access components are proprietary. Where indicated below with 'CBORD' only these components will function with this system. No 'off-the-shelf' substitutions are acceptable for these devices. Other components listed without a 'CBORD' designation are not proprietary, but preferred.

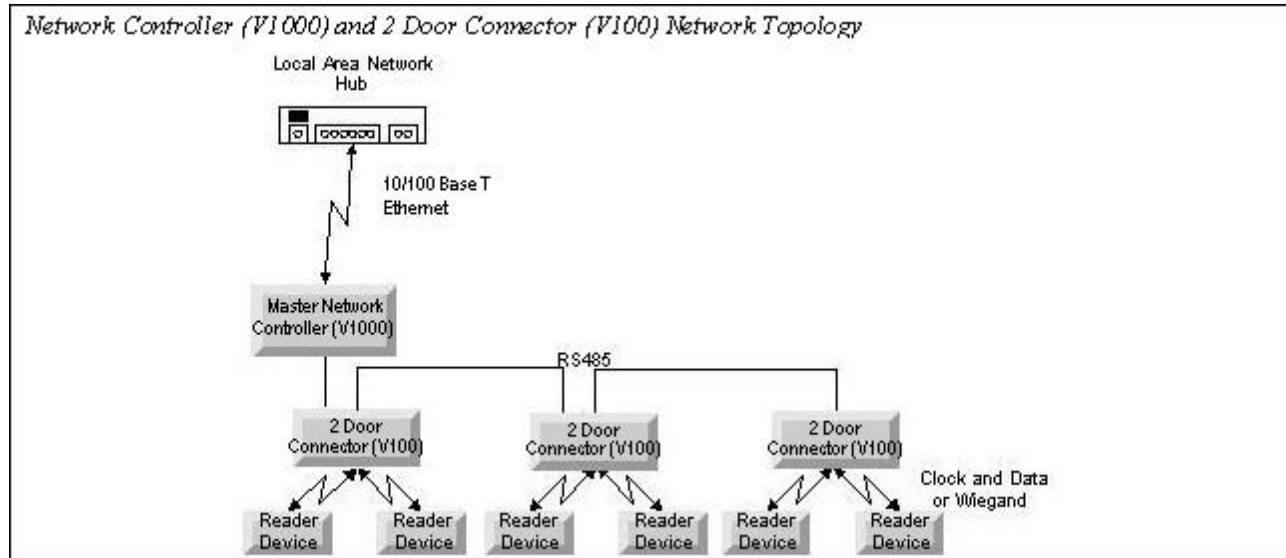
All electronic lock components (strike, crash bar, handle, etc.) must be 24v DC, with a preference for those manufactured by Von Duprin. All power supplies must have an 8-fused output power distribution block. All card reader doors must have both door monitoring and a request-to-exit (REX) position switch, with a preference that lock components have a REX built-in. All door monitoring position switches installed at double doors are to be wired together as one point. All lock components must be fail secure. Lock components may not be customized or altered unless authorization has been given by Facilities. All power supplies must have battery backup sufficient for 3-4 hours at 100% utilization. All motion sensors and door monitoring position switches are to be unsupervised.

Standard Installation Hardware:

Description	Part Number (where applicable) or preference.
CBORD Squadron V1000R Network Master	3ACSGR6730042000
CBORD Squadron V100 Door Expansion (Quantity varies based on number of doors connected to panel)	3ACSGR6730029000
CBORD Squadron V200 Input Panel (All alarm points. REX and Door monitoring when using A2005s).	3ACSGR6730030000
CBORD Squadron V300 Output Panel (Output relay panel. Strike relay for A2005s).	3ACSGR6730031000
Battery Backup, 12v, 7amp hours (provides 3-4 hours at 100% utilization).	No preference.
Power Supply 12/24v dc, 2.5a (power supply for strikes)	Altronix
Power Supply 12/24v dc, 4a (power supply for panels and readers)	Altronix
Fused power distribution block, 8 ports. (one per power supply)	Altronix
CBORD MR-5 Ruggedized Swipe Reader TK2, 12V, gray, with mounting bracket, security screw, pigtail cable, electrical grease, and 10k resistor. (One per interior door)	3ACSGR6722205000
CBORD A2005 Weather resistant reader (one per exterior door)	3ACSGR6732111000
CBORD Rain shield (where necessary)	3ACSGR4421058000
CBORD Back Box for rain shield	3ACSGR4420012000
Enclosure, 24" X 24" (or greater if necessary).	Hoffman
Panel (back plate) for above enclosure	Hoffman
Door monitoring position switch, 1" Gap, CC, ¾" D X .90 L	Flair Security Products Division, P/N VIP48 (Rare Earth Magnet), www.flairsecurity.com , 800-532-3492.
Request-to-exit position switch (where built into lock component not an option)	Visionic Ltd., Model SPY RTE-A
360 degree, ceiling mount motion sensor	Intellisense, Model DT-6360STC
Short range PIR motion sensor (40' X 40')	Intellisense, Model DT-640STC
Medium range PIR motion sensor (60' X 60')	Intellisense, Model DT-660STC
Long range PIR motion sensor (100' X 20')	Intellisense, Model DT-6100STC

You can add or install up to 16, 2 Door Connectors (V100s) on a Squadron Master Network Controller (V1000) using a Daisy Chain topology. These 2 Door Connectors (V100s) are connected to RS485 ports 1 or 2 of the Master Network Controller (V1000). Each 2 Door Connector (V100) allows two readers. You can install a total of 32 readers through each individual Master Network Controller (V1000). All alarm points are connected to Input Panel (V200). When using A2005s, daisy chain multiple readers and terminate to port 3 on V1000. REX terminate at odd points on V200, door monitor at sequentially next even point. When using A2005s, output for strike relay is controlled by V300.

NOTE The RS485 bus must be kept within the wiring closet.



Cabling Requirements

Cable required between devices is as follows:

Squadron Cabling Requirements

Application	Non-Plenum Cable (Choose One)	Plenum Cable (Choose One)	Cable Description	Maximum Length
Alarm Points to V100, V200, V2000	Alpha 2401C Belden 9462 Belden 8761 Carol C2518 or equivalent	Alpha 58411 Belden 82761 Belden 88761 Carol E2102S or equivalent	22AWG wire, shielded with drain, stranded, 1 twisted pair	1,000-ft.
RS485 Network, V1000 to V100s, V200s, V300s, Wyreless TM 485 PIM	Alpha 2400C Belden 9841 Carol C0740 or equivalent	Alpha 58401 Belden 89841 or equivalent	24 AWG wire, shielded with drain, stranded, 1 twisted pair	Keep within the wiring closet.
Mercury MR-5 Magstripe Card Reader and Dorado Magnetic Stripe Reader with Wiegand Outputs to V100 and V2000	Alpha 1296C Belden 5504FE Carol C0763 or equivalent	Alpha 58116 Belden 6504FE Carol C3311 or equivalent	22AWG wire, shielded with drain, stranded, 6-conductors min.	200 ft.

Mercury MR-5 Magstripe Card Reader and Dorado Magnetic Stripe Reader with Wiegand Outputs to V100 and V2000	Alpha 5386C Belden 5304FE Carol E2036S or equivalent	Alpha 58136 Belden 6304FE Carol C3166 or equivalent	18AWG wire, shielded with drain, stranded, 6-conductors min.	500 ft.
A2005 Magnetic Stripe Reader	Belden 9746	Belden 82757	22 AWG, Stranded, 4 twisted pair, unshielded.	1000-ft. Requires the supplied DA-15 pigtail connector (GR676-1761- 000). An external power supply is required whenever the distance from the control panel exceeds 150 feet.

Power Supply Wiring Requirements

The power supply wiring requirements are as follows:

- Squadron boards require 12 VDC power.
- Use 18 AWG stranded wire to provide power from the power supply to the Squadron boards within the enclosure.
- Power for door strikes should be sourced over a dedicated home run to the power supply that is switched through a relay output of the corresponding 2 Door Connector (V100).
- Wire size for strikes is determined by the current requirements as specified on the locking devices data sheet.
- Power supply wiring connects to a Squadron board with a screw connector. Plug the power cable of the Master Network Controller (V1000) and the 2 Door Controller (V2000) into Section P7 of the board. Plug the power cable of the 2 Door Connector (V100), the Input Monitor Interface (V200), and the Output Control Interface (V300) into Section P9 of the board.

NOTE

Refer to the Terminal Block section labeled P7. Port 3 EOL Resistor is also labeled P7 on the Master Network Controller (V1000).

Max. Cable Length for 12V or 24V Locks up to 300 mA	Cable Description	Non-plenum Cable (Choose One)	Plenum Cable (Choose One)
100-ft. (12V) 200-ft. (24V)	22 AWG wire	Alpha 2401C Belden 9462 Belden 8761 Carol C2518 or equivalent	Alpha 58411 Belden 82761 Belden 88761 Carol E2102S or equivalent
160-ft. (12V) 320-ft. (24V)	20 AWG wire	Alpha 2411C Belden 5400FE or equivalent	Alpha 58421 Belden 83602 or equivalent
260-ft. (12V) 520-ft. (24V)	18 AWG wire	Alpha 2421C Belden 5300FE or equivalent	Alpha 58431 Belden 83652 or equivalent
400-ft. (12V) 800-ft. (24V)	16 AWG wire	Alpha 2432C Belden 5220FL or equivalent	Alpha 58142 Belden 83702 or equivalent

Mounting Squadron Boards

Squadron boards are mounted inside the Hoffman enclosures. The 20 X 20 enclosure was sized to house one V1000 and up to three V100s. In installations where more panels are required, larger enclosures must be purchased. Power supplies are mounted near enclosure with a length of conduit connecting each power supply with the Hoffman enclosure.



the

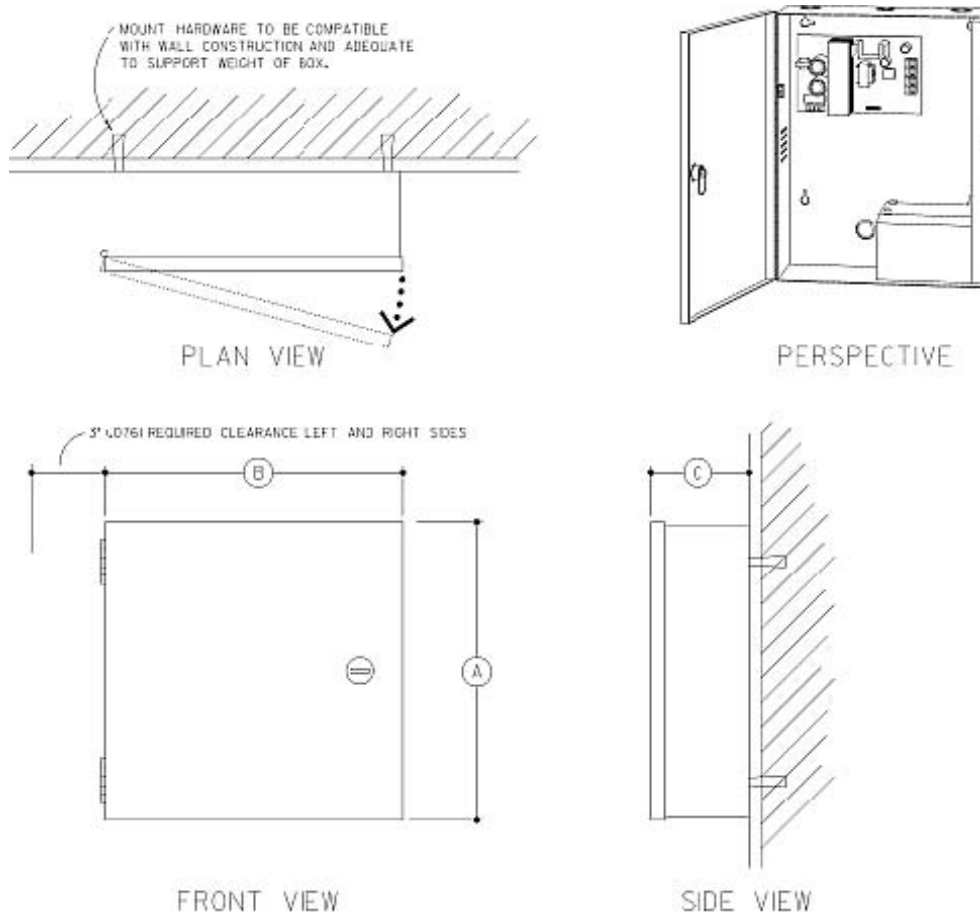


A.1.2 Mounting the Power Supply (13" H X 13 1/2" W X 3 1/4" D)



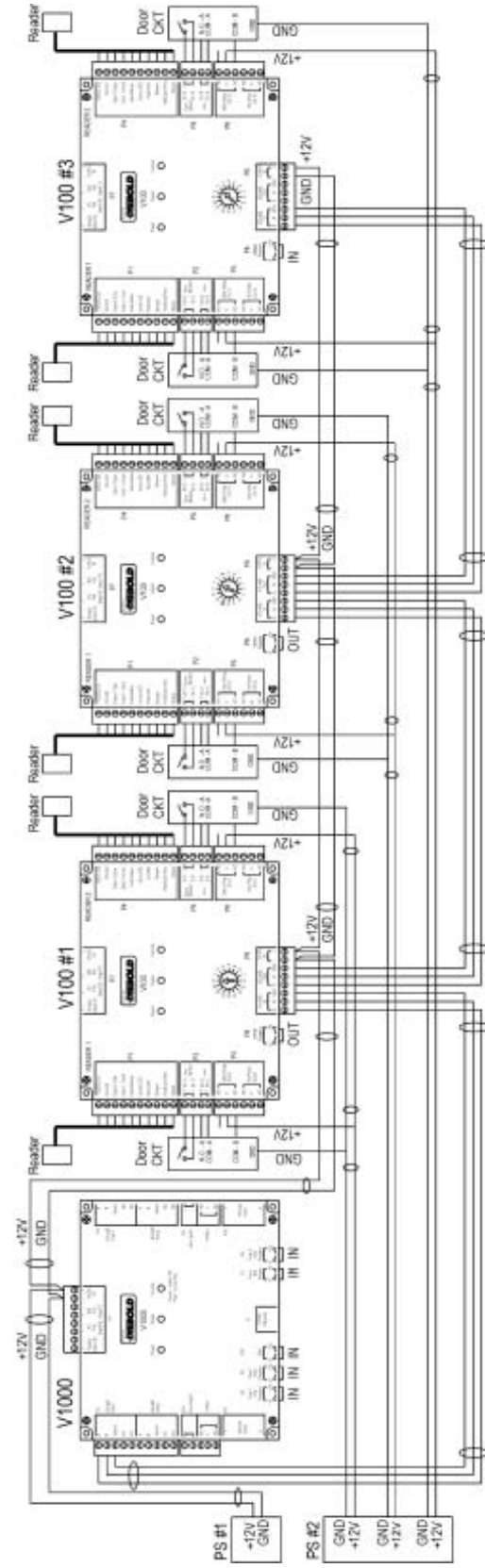
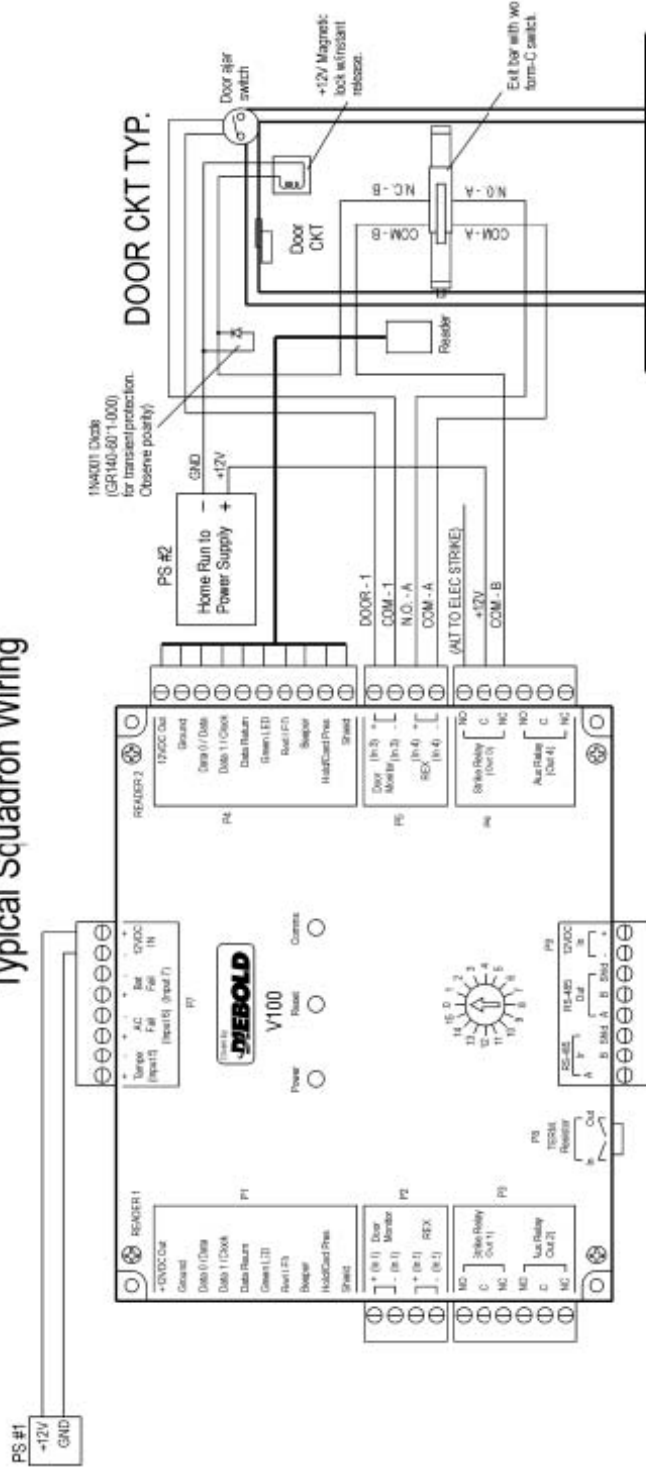
The power supply is a static sensitive device. Use standard static safety precautions while working with the circuit card assembly and the 2 Door Connectors.

Figure A-4 Mounting the Power Supply



Each Hoffman box requires two power supplies. A 4.0 Amp panel is configured for 12VDC and powers the panels inside the Hoffman. Each panel is given a dedicated fused power circuit. A 2.5 Amp power supply is configured for 24VDC and powers the door strikes. Each door strike is given a dedicated fused power circuit. Each power supply requires a standard power outlet. The duplex outlet must be within three feet of the power supplies.

Typical Squadron Wiring



A.2.7 Mercury MR-5 Magstripe Card Reader

Set the following subtype in order to use the Mercury MR-5 card reader:

19 - mercury MR-5

The maximum distance from the Mercury MR-5 magstripe card readers to the Squadron board is as follows:

- 200 ft. with 22 AWG cable
- 500 ft. with 18 AWG cable

Use the following wiring diagram when connecting the Mercury MR-5 card reader.

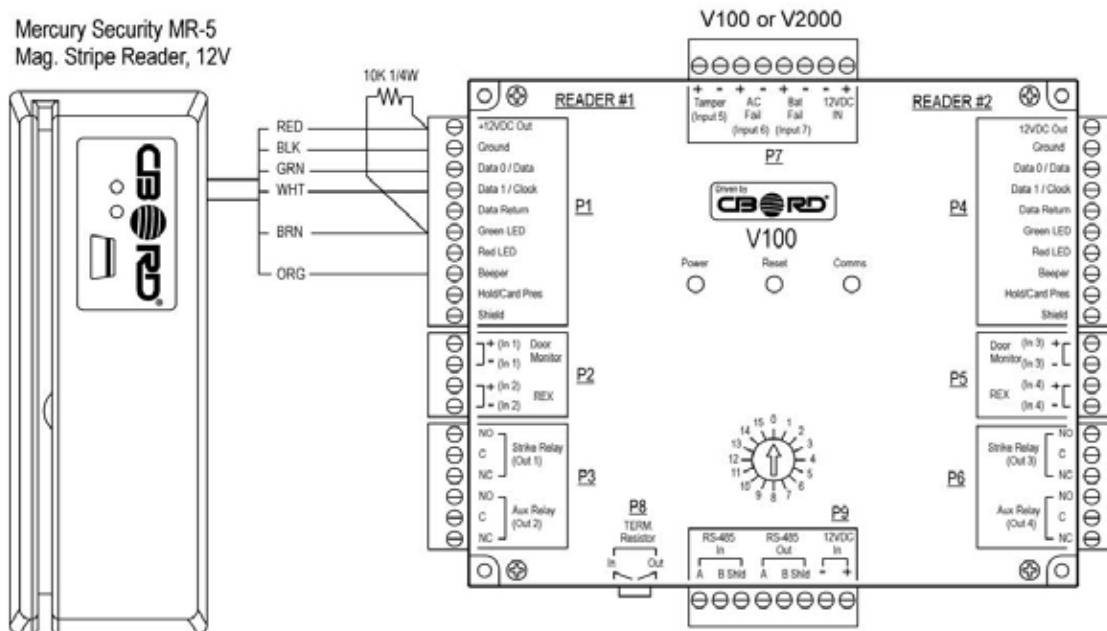


Figure A-13 Mercury MR-5 Magstripe Card Reader

A.2.4 CBORD A1005 Mag Stripe Reader

This section specifies wiring criteria for CBORD A1005 Mag Stripe Readers. A1005 Readers have the following cabling requirements:

Maximum cable distance to V1000 or V1000R:

- 200 ft. #22 AWG (8-wire) (See Table A-2 and Table A-3.)
- 500 ft. #18 AWG (6-wire) (See Table A-2 and Table A-3.)

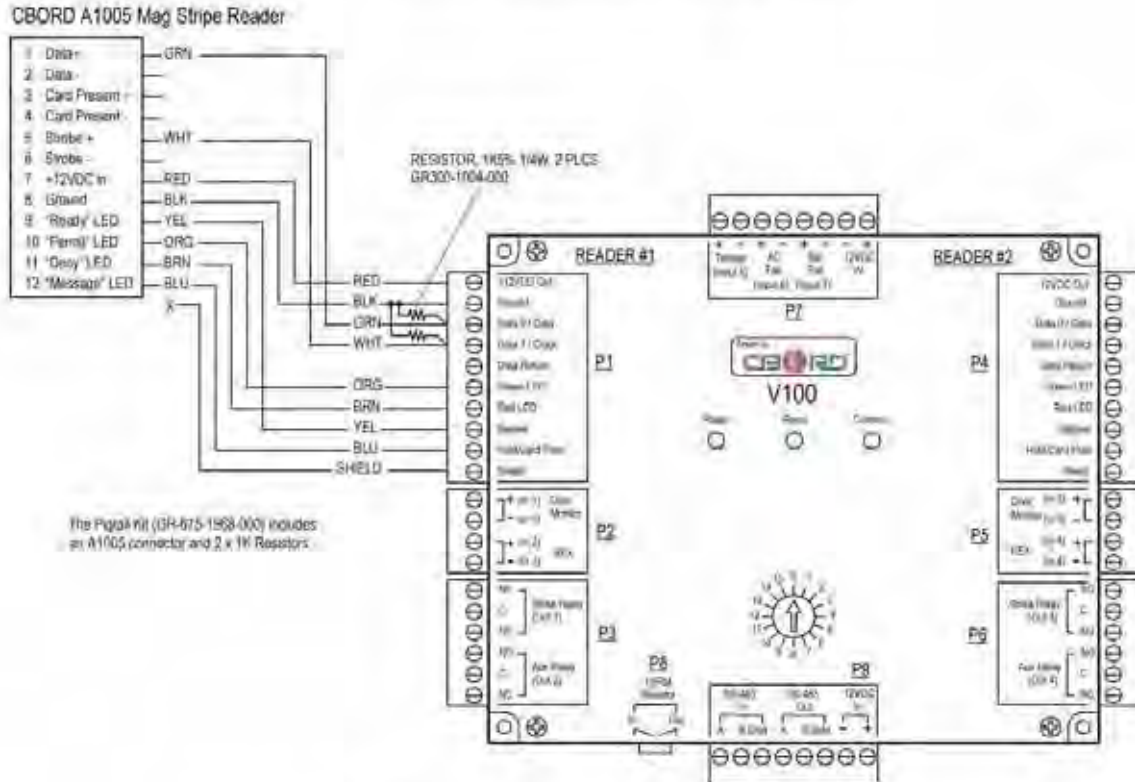


Figure A-8 CBORD A1005 Mag Stripe Reader Wiring to V100 or V2000

The A2005 readers use daisy-chain wiring when more than one reader is connected to the V1000R. The daisy-chain wiring requires only one A2005 network terminator which is located at the end of the line. (See Figure A-16.)

NOTE

Refer to Appendix A.1.3 for the power wiring requirements.

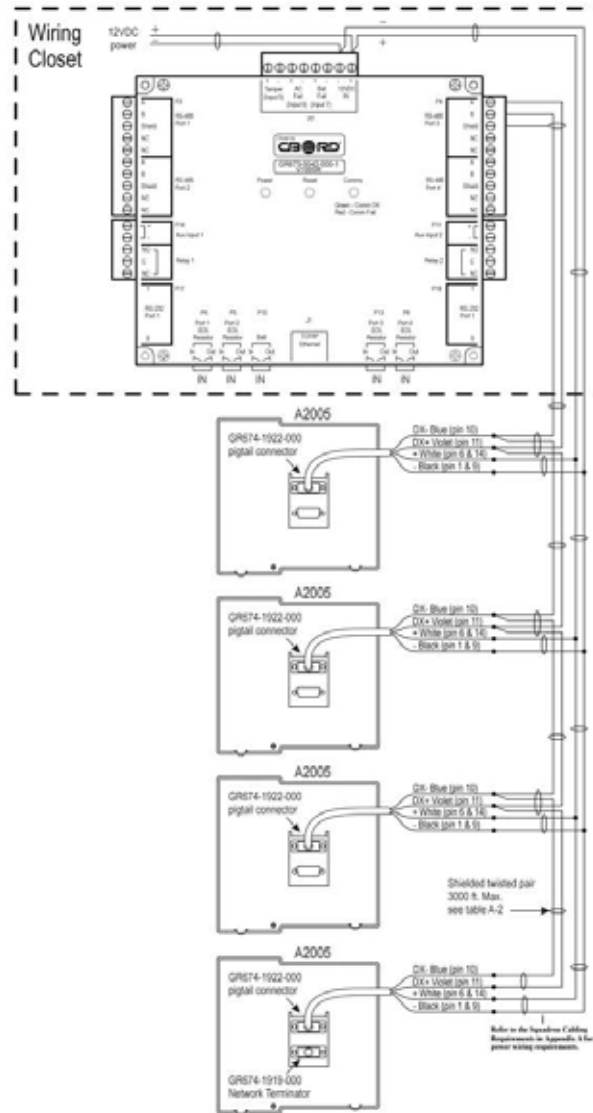


Figure A-16 Wiring Example: A2005 Reader Daisy-Chain Wiring

Squadron Specifications

Specifications for Squadron boards are listed in the tables.

*BTU/hr = Watts * 3.42 **Table C-1 Power Requirements**

Device	Power Required	Max. Heat Generation
Wyreless 2 Door Panel Interface Module (PIM)	12VDC, 300mA	3.6 Watts, 12.3 BTU/hr.
Wyreless 485 Panel Interface Module (PIM)	12VDC, 300mA	3.6 Watts, 12.3 BTU/hr.
A1005 Reader	12VDC, 130mA	1.6 Watts, 5.3 BTU/hr.
Typical 12V Door Strikes (voltage and current requirements vary; check data sheet)	12VDC, 600ma	7.2 Watts, 25.0 BTU/hr.

Master Network Controller (V1000) specifications are listed in [Table C-2](#).

Table C-2 Master Network Controller (V1000) Specifications

Master Network Controller (V1000)	Description
Operating temperature	32°-122° F (0°-50° C)
Operating humidity	5% to 95% RH, non-condensing
Operating environment	Indoors only, in secured, weather-protected environment
Typical power requirements	12VDC, 300mA, not including connected card readers
Heat generation	3.6 Watts, 12.3 BTU
Safety approval status	UL 294 and UL 1076, CSA 205
EMC	FCC Class A, Canada, EU (CE), Australia (C-Tick), New Zealand
Immunity	EN-50130-4 EU, Immunity for Access Control Systems
Relays	2 relays, each SPDT
Relay contacts	30VDC, 2.0A
Number of V100 connectors supported	16
V100 connector communications	RS485
Sense inputs	5
Host communications	10/100 Base T Ethernet
Number of locations supported	32 via V100, V200, V300 boards and or Wyreless 485 PIMs
Cardholder database capacity	1,000,000
Schedule capacity	4,000
Offline access transaction log	60,000
Offline alarm transaction log	10,000

2 Door Connector (V100) specifications are listed in [Table C-4](#).

Table C-4 2 Door Connector (V100) Specifications

2 Door Connector (V100)	Description
Power provided for each reader port	12VDC, 250mA max.
Operating temperature	32°-122° F (0°-50° C)
Operating humidity	5% to 95% RH, non-condensing
Operating environment	Indoors only, in secured, weather-protected environment
Typical power requirements	12VDC, 200mA, not including connected card readers
Heat generation	2.4 Watts, 8.2 BTU
Safety approval status	UL 294 and UL 1076, CSA 205
EMC	FCC Class A, Canada, EU (CE), Australia (C-Tick), New Zealand
Immunity	EN-50130-4 EU, Immunity for Access Control Systems
Relays	4 relays, each SPDT
Relay contacts	30VDC, 2.0A
Sense inputs	7
Host communications	RS485 to V1000
Card reader inputs	2
Number of locations supported	2